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**Oral Testimony Taken Before the Hearing Examiner****ERNEST R. ACKER****[262]***Direct Examination by Mr. Reid*

Q. Mr. Acker, on pages 7 to 8 of your testimony you stated that the public utility companies that contribute to PRDC have assets in excess of \$2 billion. Do you wish to add to or correct this statement? A. There was an omission there, Mr. Reid. It should have stated that the utility member, companies and contributors of PRDC have combined assets in excess of \$6 billion and that their total equity amounts to in excess of \$2 billion.

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Q. Mr. Acker, have you had prepared a revised statement of source and application of cash during the operating

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period 1961 to 1970 which reflects these changes in processing costs? A. Yes.

Q. Does this statement also contain schedules which reflect the effect during the operating period of the alternative tax ruling which you have requested that the contributions to PRDC are not taxable income even if PRDC itself is not held to be totally exempt from income taxation?

A. It does.

Q. Are you acquainted with the data on which the schedules included in this revised statement of source and application of cash have been prepared? A. I am.

Q. Is this the revised statement of source and application of cash during the period of operations to which you have referred? A. It is.

Mr. Reid: Will the Reporter mark this as Acker Exhibit No. 2.

(Acker Exhibit No. 2 was marked for identification.)

Mr. Reid: Mr. Examiner, we offer in evidence Acker Exhibit No. 2, the statement of source and application of cash during the period of operation.

The Presiding Officer: Is there objection to the

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receipt of the document which has been described as Acker Exhibit No. 2?

Mr. Sigal: I understand that Acker Exhibit No. 2 is a revision of the Exhibit 29 now in the record. Is that correct?

Mr. Sigal: Mr. Kyle, I make the same objection to this exhibit that I did to Exhibit 29.

Mr. Reid: Very well.

Mr. Morrisson?

Mr. Morrisson: I have no objection.

The Presiding Officer: The objection will be overruled and the document will be received.

(Acker Exhibit No. 2 was received in evidence.)

By Mr. Reid:

Q. Mr. Acker, would you refer to each of the individual

schedules in Acker Exhibit No. 2 and identify it briefly. A. Schedule No. 1 is a statement of source and application of cash during the ten-year operating period assuming that the company has no federal income tax liability.

Mr. Sigal: May I request, Mr. Acker, that you keep your voice up. I am sorry, I don't hear you very well.

The Witness: Schedule No. 2 is a statement of source and application of cash during the ten-year operating period.

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assuming that the company has federal income tax liability and that contributions are not taxable income.

Schedule No. 3 is a statement of source and application of cash during the ten-year operating period assuming that the company has Federal income tax liability and that the contributions are taxable income.

Schedule No. 4 is a calculation of Federal income tax payments during the operating period assuming that the contributions are not taxable income.

Schedule No. 5 is a calculation of annual depreciation assuming that contributions are not taxable income.

Schedule No. 6 is a calculation of Federal income tax payments during the operating period assuming that the contributions are taxable income.

Schedule No. 7 is a calculation of annual depreciation assuming that the contributions are taxable income.

By Mr. Reid:

Q. Mr. Acker, a little fuller explanation of Schedule No. 3. Does that take into account the excess of the cost of this plant over an ordinary plant? A. Yes. One income tax deduction that is assumed for the purpose of Schedule No. 3 is that the difference between the cost of this reactor plant and the cost of a conventional plant of the same capacity would be considered by the Treasury Department as research and development expense deductible.

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for Federal income tax purposes.

Mr. Reid: I see.

You may cross-examine.

*Cross Examination by Mr. Sigal.*

Q. Mr. Acker, on page 8 of your testimony you gave a brief review of the development of the reactor project with which we are now concerned, and this review goes back to April 1951. We are interested in getting a little more detail on that history than your testimony provides. Will you tell us how this whole matter started? A. I think this is the original concept of Mr. Cislser and some of his associates. In the Detroit Edison and the Dow Chemical Company people evidencing their interest in the peaceful development of the atom and notably in the production of power from nuclear fission.

Q. For what purpose were they interested in development of a reactor? A. Looking to the future use of nuclear energy for the production of power, and that of course being based on the tremendous available resources

in nuclear energy, the nuclear materials in the surface of the earth.

Q. Did they at that time, that is, in 1951, indicate to the AEC the basic conditions under which they thought that such a reactor could be developed? I am now speaking with

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particular reference to the financing of such a project. A. I am not competent to testify as to that, Mr. Sigal.

Q. You have no— A. I was not a party to those discussions.

Q. You were not a party to them? A. I was not a party to those discussions.

Q. You mean you were not individually present? A. No. My company was not associated with this group at that time.

Q. Therefore when did your company become interested in this project, Mr. Acker? A. In 1955, according to my recollection.

Q. You have no personal knowledge of what went on prior to 1955? A. Except by discussions with the individuals involved.

Q. You have no knowledge, then, of the subject I am just raising with you? A. No personal knowledge, no, except as I obtained from discussions.

Q. What discussions did you have with the individuals involved concerning the period prior to 1955? A. When our company was interested in becoming a member of the group I had long discussions with Mr. Cisler and with some of his people and with other members of the APDA organization. They informed me as to the background of



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the formation of the organization and its purposes.

Q. Then they did not tell you anything about their original notions of how this should be financed, did they?

A. No.

Q. Were you advised, for example, at any time that in December 1951 the Dow Chemical-Detroit Edison project submitted a report to AEC in which they stated that private investment in nuclear power was not feasible "without government guarantee for private capital expended and a subsidy for the materials and power produced"?

A. I am not familiar with that particular statement.

Q. That statement, Mr. Acker, appears on page 11 of a report submitted by that project and is marked No. TID-10077. Do you know what contributions AEC made to the study project which Dow Chemical and Detroit Edison were interested in?

A. Merely as a result of discussions, as I said before, with Mr. Cisler and representatives of APDA. I knew that the government was giving assistance but I was not personally familiar with the character of such assistance or the extent of it.

Q. Were you informed by Mr. Cisler that the AEC at that time, 1951, agreed to contribute \$725,000 to the project and that Dow Chemical and Detroit Edison together would contribute \$725,000?

A. No, I was not familiar with that.

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Q. This also appears, Mr. Acker, in this report that I have just mentioned.

Are you familiar with the fact that in the summer of 1952 AEC made it known to the people in this project that

it did not intend to provide a guaranteed market for privately produced fissionable material and suggested that all study groups direct their attention to so-called power only reactors? A. No, I am not familiar with that, Mr. Sigal. As I have said, I was not a party to any of those discussions.

Q. You are not familiar, then, Mr. Acker, with the discussion which extended over a considerable period with respect to the relative merits of single purpose and dual purpose reactors? A. Only to the extent that I would be familiar with them by reading.

Q. You got nothing about that from Mr. Cisler or his associates? A. I can't recall that I did specifically.

Q. Were you informed of the safety problems that the study group was considering with reference to the power reactor? A. I was familiar with those at the time that my company came into the APDA organization.

Q. I call your attention to the following language on

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page 162 of this report to AEC before I quote that. This is with reference to the matter of safety and exclusion. Quote:

"Exclusion area, no matter how large, is not the answer to the atmospheric contamination problem. Instead the reactor enclosure must be designed to contain sufficient of the fission products to eliminate the hazards to surrounding territory resulting from reactor failure."

Are you familiar with that subject matter? Were you told about the problems involved? A. Yes, I have been a party to many discussions. I was at the time that our

company came into APDA and have been since, on that whole question.

Q. But you were not aware of the statements that were made at that particular period on the subject by Dow Chemical? A. Not during that period, Mr. Sigal.

Q. Are you aware, Mr. Acker, that on April 14, 1954, AEC entered into a new agreement in which AEC agreed to do \$300,000 worth of the work involved in this study project? A. No, I am not personally familiar with that.

Q. Are you aware that the primary purpose of the study was, or to put it in the language of the report, quote, "emphasis has been placed on the subject of nuclear accident."

Were you aware of that? A. I am not.

Q. This report also states, Mr. Acker, at page 72 that,

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quote, "Some effort has been devoted to studies of other types of reactors." Then it goes on to say at page 75, quote, "In view of the urgency felt by private enterprise to construct a working, full size power breeder it is concluded that the best interests of the group will be served by continuing the major effort on the fast breeder."

Are you familiar with that matter, that statement or the attitude described? A. I am not familiar with the statement, as I have said before. As far as the attitude expressed is concerned, it seems to be entirely consistent. If you want my opinion and based on what has transpired since, we believe that the fast breeder reactor holds the greatest promise from the standpoint of the conservation of nuclear fuels and the ultimate economy of power production through the use of nuclear energy.

Q. Mr. Acker, perhaps you didn't get the quote clearly. Let me read it again: "In view of the urgency felt by private enterprise to construct a working full size power breeder, it is concluded that the best interests of the group will be served by continuing the major effort on the fast breeder."

The group referred to in this statement of course is private enterprise. A. I would think it referred to the group that was

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involved in the project.

Q. Then you are still of the position that private enterprise will be best served by building a full size power breeder? A. I would interpret it that way, Mr. Sigal. I would interpret it to mean that the best interests of the group as those responsible for the provision of the power requirements of their customers, would be best served by this action.

Q. You are not familiar of course with the document, as you stated? A. No, I am not.

Q. Or the discussions that went on at the time, are you? A. That is right.

. . .

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By Mr. Sigal:

Q. Mr. Acker, calling your attention to Exhibit XXI, the first page. Do you have it before you? A. Yes.

Q. Article 1, Section A, the first sentence contains this statement, quote: "APDA will furnish to PRDC without charge a complete design for those components of the

reactor plant within and including the secondary containment vessel and for the primary coolant loops which collectively are

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herein referred to as the reactor proper, as identified on exhibits A and B of this agreement."

Do you know what those components will cost APDA to produce? A. I don't think I have a statement of the cost of those particular components. I can furnish it.

Q. You have no knowledge of your own on that matter? A. I have a statement of all of the components which APDA will furnish to PRDC.

Q. A statement of all the components? A. Yes.

Q. You mean a list of them? A. Yes.

Q. Yes, but I am asking you do you know the cost of the components listed in paragraph A? A. That could be identified from the list which I have. I haven't a separate list as to these specific ones. I have those included in both A and B.

Q. Does that list give the price of each item? A. It gives the estimated cost of the item as we have included it in our cost estimate.

Q. Your answer is, then, that it does give the cost of each item. A. It doesn't give the cost, Mr. Sigal. It gives the estimate of the cost at which each item is included in the

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PRDC construction estimate. In other words, it gives the cost which we will be relieved of by reason of receiving these components from APDA.

Q. Are you drawing a distinction between the actual cost of the item and the cost that is included in the estimate? A. I am drawing a distinction between the cost to APDA, which is purchasing and erecting this equipment, and the cost at which those items are included in our cost estimate, that is, PRDC cost estimate.

Q. I see. Do you have, then, a statement showing the cost to APDA of each item and the cost to PRDC of the same item, and so on, for all the items which APDA will transfer to PRDC. A. I want to be sure that I understand your question and that I am giving you a responsive answer. I have a list which shows the items, the cost attached to each item in the PRDC construction estimate. The cost to PRDC will be nothing because they will receive this equipment in APDA without charge. The cost to APDA has only been determined of course to the extent that orders have actually been placed and bids for the equipment have been received from manufacturers.

Q. Do you have that list? A. Yes.

The Presiding Officer: Will this be an exhibit, Mr. Reid?

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Mr. Reid: Not ours, no.

Mr. Sigal: Shall we mark this Acker No. 6?

The Presiding Officer: Acker No. 6. The document will be marked Acker No. 6 for identification.

(Acker Exhibit No. 6 was marked for identification.)

The Presiding Officer: Will you furnish the Reporter a copy?

Mr. Claytor: Yes, we will.

By Mr. Sigal:

Q. Is this list which we have identified as Acker No. 6 complete for all of the equipment and devices which APDA will provide to PRDC? A. Yes, it is.

Q. You have listed in the first column the estimate material cost. What does the estimated material cost cover? A. It covers the finished cost of the particular piece of equipment referred to.

Q. That is the manufacturing cost? A. That is right.

Q. Does that include design cost? A. No, it does not.

Q. Does it include engineering cost? A. To the extent that the manufacturer did any engineering in connection with it, yes.

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Q. But to the extent that APDA did any engineering, it does not? A. No, it does not.

Q. Are you familiar with the estimate of the design and engineering costs to APDA of these items listed on Acker No. 6? A. Not specifically, no.

Q. Are you familiar generally? A. Yes, I know what APDA has spent and proposes to spend for design and development costs.

Q. But you do not know what the design and engineering costs are specifically with reference to each one of these items? A. No, I don't.

Q. The second column is headed estimated installation labor. What labor is that? A. That is the labor of erection on the site of these various items of equipment.

Q. Is APDA going to install each of these items in the reactor plant of PRDC? A. That is right.

Q. At what point does PRDC accept transfer of these items—prior to installation or when the installation is complete? A. After APDA had completed the tests.

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Q. And before installation? A. No, no. After they have completed their tests of the complete installation?

Q. Of the complete installation? A. That is right.

Q. The tests you are referring to are the tests in the reactor itself? A. The test of this particular equipment which APDA is going to build and finance itself.

Q. You have listed a column entitled contingencies. Do you know how the figures were arrived at there? A. Those contingencies are the portion of the contingency items included in the PRDC construction cost estimate which relate to these various components.

Q. Do you know how the figures were determined? A. They represent varying percentages of the direct material and labor costs.

Q. Well you explain that statement? A. In some cases where the design is completed, where we have received manufacturers proposals or made contracts with manufacturers for the manufacture of the equipment, the contingency item might be 10 per cent.

Q. You say it might be 10 per cent. How do you— A. I can identify particular items if you are interested in knowing that.

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Q. Yes, take a particular item on which you say the contingency is 10 per cent, how do you arrive at the 10 per cent? A. That is based on experience in estimating



conventional steam station plants. Where we don't have the background of experience that we have in connection with conventional plants, we would use anything from 15 per cent up to 30 per cent contingency. So it is a judgment figure, Mr. Sigal. Those are judgment figures.

Q. You mean based on past experience? A. Based on past experience or current experience based on the exposure to unknown or uncertain elements.

Q. Let us take the very first item, reactor vessel. You have a contingency there of \$171,600 against a total cost labor and material of \$1,144,800. A. Yes.

Q. Will you tell us how you arrived at that contingency? A. On the basis of a percentage applied to that direct material and labor cost.

Q. Yes. How did you arrive at the percentage? We are now talking about a reactor vessel which has never been built before. A. That is included, Mr. Sigal, in a category listed in our construction estimate, which is an exhibit in this case, under a heading called reactor plant construction. I

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beg your pardon a moment. (Witness referring to his papers.)

That is included under a heading in our construction estimate called reactor plant equipment, and the reactor vessel is included in a group of material as to which we have assigned a contingency item of 15 per cent. The particular reason for that is that the reactor vessel itself is the largest single element in that category and we have a proposal and have placed an order with the Combustion Engineering Company for that reactor vessel at a figure which is shown.

Q. You placed an order for the reactor vessel at the price which is shown? A. No, because there are other elements aside from just the purchase of the reactor vessel itself. Of the \$1,062,000, the reactor vessel, based on the proposal of Combustion Engineering, is \$915,800.

Q. What is that figure? Is that the contract price? A. That is the Combustion Engineering proposal on which an order has been placed with Combustion Engineering.

Q. For the reactor vessel? A. For the reactor vessel.

Q. Why did you charge \$1,062,000 for that item? A. I say there are other items included there.

Q. In this reactor vessel item? A. That is right.

Q. What other items are included?

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A. There is an allowance for extras such as loop stub piping also, thermocouples, expansion joints, for nuclear operation. We have an item to cover escalation. There is heating system material. That is heating coils for keeping the sodium fluid during the reactor shutdown. There is the erection cost. There is the rest of the reactor vessel. There is the reaction cost of the heating system.

Q. Is that all included in the million dollar item? A. There is steel shielding. The entire item which we have listed here as reactor vessel, steel shielding, internal structures, and heating system, in our estimate adds up to \$1,373,900. We will receive this vessel and other portions of that equipment from APDA to the extent that it relieves that total cost of \$1,373,000 by \$1,316,000.

Q. What is the difference? What does that difference represent? A. The difference is in items which PRDC will itself provide.

Q. Mr. Acker, getting to the question that I asked you originally, how did you determine or how did APDA determine this contingency of \$171,600 for the item of reactor vessel? Did they apply just a mathematical formula and say "This is what it will be", or was it related to some more specific information and possibility. A. It was a mathematical application of 15 per cent

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to the material and labor costs based on our judgment as to the exposure that we had for contingencies for this class of item.

Q. What experience have you had or has PRDC had with the building of reactor vessels? A. This is our first experience.

Q. So you can't rely on your experience to determine what the contingency is, can you? A. Generally speaking, that is right. Maybe, but I would like to point out again, as I said, that the major portion of the cost of this item is based on a proposal and an order which is already placed at a figure. So as to that portion of the total we see no reason that we should go any further than a 15 per cent contingency.

Q. Then your contingency is not related to the question of whether or not PRDC has determined the problems of safety with respect to the reactor vessel? A. I don't understand your question.

Q. I would like to know, Mr. Acker, whether this con-

tingency reflects to any extent any problem or doubt with respect to whether or not the reactor vessel as designed will meet the need. A. This contingency item, Mr. Sigal, is not intended to provide for changes in the design or structure of the equipment.

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Q. I see. That is true with every contingency item which is mentioned in this estimate and in the other estimates, that you have submitted? A. That is true, except to the extent that the design of some of the items may not have been completed as yet and if modification of those items is necessary then the contingency item would cover the cost of the modification.

Q. But generally speaking, certainly, so far as what you have presented here, the contingencies do not include the cost of design if changes are required? A. It might cover some of the cost of design changes but not the construction of a new piece of equipment which is to replace one which is included here.

Q. Whether or not it does include design costs, you are not certain? Is that true? A. I am not saying, Mr. Sigal, that it would include no design costs but we have other provisions for research and design changes which may be necessary in the future.

Q. So in any event with respect to these various estimates the item of contingencies is not intended to cover the design costs with reference to changes that may be required in these items? A. It may be adequate in some instances to cover the design changes. That is the point I am trying to make.

Q. Do you know of any instance where it might be

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adequate? A. In the case where we may have applied 30 per cent contingency knowing that we had only a conceptual design and didn't yet have a definitive design 30 per cent might be adequate. I am not saying there is nothing available there for design change.

Q. Can you point out any specific item where the contingency might be sufficient for that purpose? A. I would say as to any item where we have up to, say, 30 per cent contingency it is entirely possible that a portion of that that would be available for design changes.

Q. Some portion? A. Yes.

Q. Can you say what portion? A. No, I can not.

The distinction that I am trying to draw, Mr. Sigal, is that we do not intend the contingency items to provide for any changes in the construction of pieces of equipment or to take care of modifications of pieces of equipment which have to be substituted for items included here.

Q. You mentioned in the course of your statement that the contract includes escalation. Will you explain the word escalation? A. Escalation is the provision you make for increased labor and shop material costs.

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Q. What provision have you made for escalation? A. There is a total in this classification of items which includes the reactor vessel of \$91,000.

Q. Is that escalation item part of the figure that is given here as to the cost of the item? A. Yes.

Q. Is that true with respect to all other items? Do they all contain escalation provisions? A. As to I would

say the bulk of the items in our construction estimate, we have allowed for escalation, yes.

Q. Is there a flat percentage of escalation? A. I can not tell you, Mr. Sigal, the exact basis on which the escalation is determined. I can tell you who made the estimate and get the information for you if you wish to have it.

Q. Do you have with you the work sheets for the various estimates that you have provided with respect to costs and expenses? A. I do not.

Q. Do you expect to have them? A. I hadn't expected that they would be required. If they are, they can be made available, I should think.

Q. A request was made, Mr. Acker, that the work sheets that you used or PRDC used with respect to the various estimates be available. You know the various statements

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you have submitted on costs, operating expenses, and so on. We are interested in examining those work sheets whenever questions may arise. A. It is a very voluminous record, Mr. Sigal.

Q. Of course you are undoubtedly in a better position to know than we are. We are interested in being able to check those work sheets from time to time. Can they be made available tomorrow? A. I don't believe that is possible.

Mr. Claytor: Mr. Sigal, I think that the detailed work sheets to which you have made reference are available here in the form of further breakdowns and analyses of each item in the construction estimate. With respect to the construction estimate

we can make those available to you now. With respect to any other items I think we would have to see which items they are. Certainly with respect to the construction estimate we have this available if you wish it.

Mr. Sigal: Can you give me a copy? May I have it, please?

I am also requesting the work sheets for the other exhibit, Mr. Claytor, the operating expenses during construction, and income and operating expenses during operation. They may be made available.

Mr. Claytor: Yes.

I would suggest that as I hand these to you they be

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marked for identification for the future. This would be Acker Exhibit No. 7, work sheets on construction estimate, Application Exhibit No. XXVII.

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Q. Did you have anything to do with the organization

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of PRDC, Mr. Acker? A. Yes. I was one of the original members.

Q. Are you familiar with the circumstances under which it was organized? A. Oh, yes. Very early in the organization of PRDC I was appointed chairman of the



finance committee and I later on became vice president of the company.

Q. Mr. Acker, there are now 21 members of PRDC, is that correct? A. That is correct.

Q. Is there any obligation on the part of these members to continue their membership for any particular length of time? A. No.

Q. Aside from any written commitment which the members may have given to PRDC is there any additional commitment for contributions by these members to PRDC?

A. No.

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By Mr. Sigal:

Q. The first sentence of Article I says that it will continue in effect for a period of ten years, but in no event beyond December 31, 1970. Your own statement indicates that you will not operate this plant beyond 1970.

Do you know why AEC gave you an allotment for 23 years going up to 1980? A. Just a moment, Mr. Sigal. I don't think I have ever stated in any testimony that we would not operate this reactor plant beyond 1970. It is our intention to operate it for a ten-year period.

Q. That is 1970. A. For this purpose. But we have never stated that we would not operate it beyond that period.

Q. You have not stated that? A. No, sir.

Q. Is it your intention to operate it beyond 1970? A. I can't say today. It would depend upon the results of our operation during the ten-year period.

Q. In that case, Mr. Acker, may I call your attention



to what you said on page 24 of your testimony about the middle of the page. Your statement begins, "The period projected for the experimental operation of the reactor plant upon

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completion of the test year 1960, is ten years. We feel that at least the ten years will be required to study adequately the economic and technical aspects of the operation of the fast breeder reactor as a facility for the production of steam, usable for the generation of electricity."

Is that statement not inconsistent with what you have just said? A. I don't think so.

Q. You think that this says that you will operate for more than ten years? A. No, I don't, but my statement, Mr. Sigal, was that we had never made the statement that we would not operate beyond the ten year period.

Q. Oh, I see. All you have done is make an affirmative statement that you will operate for ten years? A. That is right.

Q. I see. A. That is geared to the period that we think necessary to prove out the economics of the plant.

Q. It is your position that none of the statements you have submitted here indicates that it is not your intention to go beyond ten years? A. That is right.

Q. That it is not your intention not to go beyond the period?

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A. There are two negatives in there. I will have to think about that.

Q. I will state it affirmatively. Is it not true that the

statements you have submitted indicate that PRDC will operate for only ten years? A. That is not true.

Q.<sup>2</sup> That is not true? A. No.

. . .

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Q. On the next page, page 7, in paragraph E it says, "The Commission will and hereby does waive its use charge for special nuclear material used in connection with the project for the period commencing with the effective date of this contract and ending five years after commencement of operation of the reactor plant as established in accordance with the provisions of Article I."

If this contract is signed, say, this month, March 1957, and the plant doesn't go into operation until sometime in 1960, can you explain why the Commission would provide special nuclear materials for the period between the effective date of the contract and the date when the reactor goes into operation? A. During that period the fuel elements would be

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expected to be fabricated and special nuclear material is necessary for that purpose.

Q. In 1957? A. Not necessarily in 1957.

Q. The allocation provides for nuclear materials from the effective date of this contract. That is what it says here. Why would you need nuclear materials in 1957? A. I don't think we do. I think we are scheduled to need them in 1958.

Q. That is what the agreement provides. A. I can't see any objection to that, Mr. Sigal.

. . .

[448]

Q. As a matter of fact, this whole project rests on the proposition that it can not operate unless AEC buys plutonium produced in this reactor? A. I think that is a fair statement. It could be operated—No, I think that is a perfectly fair statement.

[449]

Q. In any event certainly PRDC will not operate this plant if it can not sell its plutonium to the government, to AEC? A. That is true.

. . .

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Q. As a matter of fact, I assume you know, Mr. Acker, that no fast breeder reactor has been built which has survived all tests made? A. I think that is a fact.

Q. So there is now no experience in any organization, be it AEC or PRDC, with respect to the building of a successful fast breeder reactor which is safe.

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A. I would not make that statement, Mr. Sigal.

Q. Because you have no knowledge of it yourself? A. That is right.

Q. You say that the risk to PRDC is roughly the cost

of building the reactor, namely, about \$40 million. Well, what— A. I would say it is contributions to which the member companies are committed plus the amount of the loan which they will have guaranteed.

Q. That is about \$38 million? A. About \$38 million.

Q. What provision has PRDC made to meet that risk? A. That financial risk?

Q. Yes. A. I don't know that it has made any provision. If it had made provision, Mr. Sigal, it would not be a risk.

Q. When you say that there is a risk in proceeding now are you asserting that if the schedule can not be met, PRDC will abandon the project rather than put any more money into it in order to build it at a later date? A. No, I am not saying that at all.

Q. All right, then, I am asking you what arrangement has PRDC made to meet the risk that its original plans may not work out? A. It has made no arrangement. Whatever arrangements

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were made would depend on the circumstances at the time that it was faced with that decision.

[494]

By Mr. Sigal:

Q. Mr. Acker, will you look at page 5 of this exhibit, this summary? A. I have it, Mr. Sigal.

Q. That shows at the end of the total estimated plant cost; is that right? A. That is right.

Q. \$32,400,000? A. That is right.

Q. That does not include, does it, certain other engineering and research matters that are necessary during construction?

For example, that item does not include the \$5 million that PRDC says it will spend during construction, does it? A. That is right.

Q. Can you tell us what is the actual cost of construction, including all items spent during the period that you call the construction period? A. That would be shown on page 7. Do you have a page 7 to your exhibit?

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Q. Yes. A. \$43,216,000.

Q. Is that cash outlay by PRDC? A. No, that includes \$7 million received in test equipment and devices and research and development expense by APDA.

Q. So according to that figure, the amount of money actually expended by PRDC would be \$36,216,000; is that right? A. That is right.

Q. If that is the amount actually expended during that period, what amount will PRDC have in its reserves at the time that construction is completed? A. As I remember it, Mr. Sigal, PRDC will have a balance at the end of the construction period of \$3,499,000.

Q. How do you derive that figure? A. I think that is stated in my testimony, Mr. Sigal.

The Presiding Officer: Page 13 of your testimony?

By Mr. Sigal:

Q. You stated that in the first paragraph on page 13.

Can you tell us how you derived this figure? A. Yes, anticipated total resources of PRDC, including the \$7 million from APDA, is \$45,540,000. The reactor cost, overall, including the \$7 million value placed on the contributions of APDA, is \$43,216,000, and the difference, I think, is \$2,324,000.

If you add to that the provision for working capital

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which we expect to have at the end of the construction period in hand, you get a total of \$3,499,000.

Q. If you are going to include that \$1,175,000 as a statement of your excess over costs, then certainly you ought not to include that same \$1,175,000 in the statement of your construction expense, should you, Mr. Acker?

A. It depends on how you want to show it, Mr. Sigal. That is a provision which must be made and must be available during a construction period involving expenditures of this size to provide for meeting payroll, meeting all kinds of expenses from time to time.

It, in effect, Mr. Sigal, is the amount that you hope to maintain and expect to maintain and should maintain in your bank account to meet whatever disbursements are necessary. It is not considered as an expendable item, in other words. It is a provision for evening out your expenditures over a period.

Q. It is not a fund or a sum that you spend? A. That is right.

Q. So to call it a cost of construction, as you do on page 5, is stretching it a little, isn't it, Mr. Acker? A. I don't think so. I think it is an item that anybody faced with the construction of any plant must take into con-

sideration: The money must be provided whether it is expended or left over at the end of the period. It has to be in hand and has to be in the bank available for use.

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Q. In any event, your statement is that this is not a sum that you intend to expend? A. That is right.

Q. During the construction period? A. That is right. You will see by the same token, Mr. Sigal, that it is continued all through the operating period, as well.

Q. Yes.

Does this construction estimate, this exhibit, indicate all the expenses that you anticipate having during the construction period? A. It does.

Q. This does not cover any expenses that go beyond the construction period, does it? A. Let me check that.

Yes, this includes an item of \$550,000 for initial operation from low to full load which covers the cost of the test year which immediately follows the completion of construction.

Q. Why did you include that item in the construction estimate if this is not attributable to construction? A. It is a question of judgment as to where to put that kind of item, Mr. Sigal. Is the test year part of the construction period or is it a part of the operating period? That is just a question of semantics, it seems to me.

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Q. In your opinion, at least as this exhibit reflects, the test year is part of the construction period? A. To the extent that we have included the cost of conducting the



test during the test year in the construction estimate. It might be put that way. It really doesn't make any difference, Mr. Sigal. You have to make the provision either way; however you want to characterize it.

Q. This is for the purpose of analyzing your statement, Mr. Acker. All I am asking is, is it not true that PRDC judged this to be a construction cost inasmuch as it included the item in its construction estimate? A. I suppose that inference could be drawn. It seems to me it is academic.

Q. Is it a fair statement to say that in your testimony whenever you refer to construction and its cost, you refer to the matters which are included in this construction estimate? A. That is right.

Q. Will you examine Item L, that is, the detail on the preoperation testing after construction? A. Yes.

Q. The introduction to this statement—by the way, I am quoting from Item L in Acker Exhibit No. 7 for identification—quite:

“This capital item is an expense that occurs before the plant is ready for commercial operation. It includes

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only operating expenses and does not include any of the costs of money or taxes other than social security taxes.

“The expense is incurred after completion of the plant construction and before it becomes critical. It includes final adjustments to all plant equipment, minor changes and an item for inspection and testing of the initial loading of core and blanket elements. In addition, the expense covers several weeks that



are required for the progressive loading of the reactor core, carefully measuring the approach to criticality after the addition of one-third of the core elements and again after each additional element is added to the core. The hold-down plate is lowered, the reactor locked, and control rods lowered after each element addition."

The cost of that item is \$350,000, estimated. A. Right.

Q. The description there indicates what has to be done up to the point of reaching criticality, doesn't it? A. That is right, up to the point of beginning of operation of the plant.

Q. The actual operation? A. That is right.

Q. Of course, it includes, as it says, the insertion of nuclear fuel into the reactor? A. Yes. Obviously that can't be done until we get an

[500]

operating permit.

Q. Is that so? A. That is right.

Q. Where does it say that, Mr. Acker? A. It doesn't say that.

Q. You know that of your own knowledge? A. I believe that to be the fact.

Q. Is there anything in the record which so indicates? A. Not that I know of.

Q. Will you turn over to Item N, which is titled, "Initial Operation, Low to Full Load"?

"This allowance provides for the cost of one year's operation that is required to bring the reactor to a condition of safe operation at full load. After the reactor becomes critical it is loaded to give a small

heat output and the control and safety rods operated to determine their effectiveness. These tests are repeated many times in the process of calibrating control rods and proving that the safety rod characteristics are satisfactory.

"After these tests which require several months, other tests estimated to take about six months will be performed. These tests required to prove reactor stability include a long series of tests with oscillating reactivity applied to the reactor core with programmed reactor

[501]

loadings and oscillator frequencies."

A. Right.

Q. Are you prepared to explain that second paragraph?

A. No.

(Laughter.)

You knew the answer in advance, Mr. Sigal.

Q. In any event, Mr. Acker, it is clear from this statement that this refers to a process which is involved in the operation of the reactor after it reaches criticality? A. That is true, Mr. Sigal.

Q. I assume you are aware of the fact that perhaps the most dangerous period in the life of a reactor is the moment of bringing it to criticality? A. I cannot state that as a nuclear expert, Mr. Sigal, but just as a layman I would assume that that would be a proper statement.

This operation obviously is another that could not be undertaken until we have an operating license.

Q. Under this statement, Mr. Acker, it appears that the

preoperation testing in the initial operation to full load will begin somewhere around 1959 or 1958? A. It is scheduled for the end of 1959. The preoperational testing would be at the end of 1959. The initial operation low to full load is scheduled for 1960.

Q. The entire year? You mean it will begin in 1960?

[502]

A. That is right. Our program and all of our operating schedules have set aside the full year 1960 for that operation.

Q. Will you look at Figure No. 1 which was referred to before in Mr. Amorosi's testimony?

You will note there on the right-hand side of that figure, under 1960, that the preoperation testing is to begin in December of 1959. The criticality date is set at December 15, 1959, according to this picture; is that right? A. According to this statement, that is true. I think there is a difference in terminology.

Q. Mr. Acker, I don't know whether the PRDC representatives differ in their use of these words, but this figure uses the precise language that you have used in the construction estimate. A. That is true, Mr. Sigal.

Q. This whole year of 1960 is shown as devoted to preoperation testing. If a year is devoted to that, then it would appear that another year, 1961, will be required for the second operation, namely, the initial operation low to full load, according to your own statement. A. Mr. Sigal, that is not the intent. There is a confusion of terms here, and I will readily admit it. The preoperation testing as included in Mr. Amorosi's exhibit is the item which we dis-

cussed before in our construction estimate designated N, Initial Operating, Low to Full Load.

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Q. \* \* \* I think I asked you earlier about a possible breakdown of the \$5 million estimate on research and development by PRDC, and your statement was that that wasn't available. A. That is right, there is no specific schedule of proposed research and development expense. That is an allowance for whatever we may do or be required to do.

Q. There is an item of \$4 million by APDA for similar work. Is there any breakdown of that? A. That is included in the APDA budget for the years 1957, 1958 and 1959, which is in evidence in this proceeding.

Q. You have no other breakdown than what appears on that exhibit? A. I have none.

Q. You are aware, are you not, Mr. Acker, that the experts and consultants for PRDC anticipate that there may

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be substantial changes in components during the course of construction and prior to the time they actually get into operation? Are you aware of that? A. During the course of construction?

Q. Yes. By "construction" I am taking it up to the point of actual operation. A. There may be changes required as a result of the test of the APDA equipment and devices which they propose to furnish to us.

Q. Or as a result of the research work done by APDA

or PDRC there may be changes required? A. That is conceivable; yes.

Q. Or work done by AEC? A. That is conceivable.

Q. Or any consultant that you may use for this purpose? A. Yes. The reason that I qualified what I said previously was that all that work that you refer to will be in the course of completion during this three-year construction period successively. If the result of some of the tests that are to be made show that changes are required in any of the proposed components of the reactor plant before they are actually fabricated, then, of course, we will not be subjected to additional cost for new items.

Q. What happens if you learn about these things after the designs are frozen?

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A. Then we are exposed to additional costs for new design. If the piece has been fabricated, we are certainly exposed to the cost of replacement.

Q. What provision have you made to meet that contingency? A. We have \$5 million, as I told you, which is unassigned for the most part.

In addition, in our estimate we show as the estimated cost to us of the equipment and devices which APDA will furnish us about \$4,100,000. In our financial statement we have estimated the value of those pieces of equipment and devices at \$3 million.

That is in on both sides of the equation. We have considered that as a cost in our financial schedules and we have considered it as a receipt. We could have put it in dollars on either side. The difference between that \$3 million which we have in our financial schedules and the

\$4,100,000 which is included for the same items in our construction estimate, perhaps \$1,100,000, would be available for such changes and adjustments as have to be made.

Q. So your estimate, then, is that you will have \$1 million available for that purpose? A. We will have \$1 million, plus whatever portion of the \$5 million which would be available for the purpose, as well.

Q. Let us assume, Mr. Acker, that the amount required to make the changes exceeds \$5 million or \$6 million. What

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will PRDC do to meet that contingency? A. Mr. Sigal, you are asking me personally. I am not the least bit concerned about that. These companies will have put in \$25 million, and will have put into APDA reserve previously \$6,700,000, something on that order. With that kind of investment in a very important project, I see no possibility—if you want to qualify it, I will say no reasonable possibility—that these companies would not come forward and put up the additional money required to complete the job which they had undertaken.

Q. The fact is, Mr. Acker, that PRDC does not have the resources now, it doesn't have any commitments to take care of any of the contingencies you are now mentioning, does it? A. Yes.

Q. What is the provision? A. It has the \$1,100,000 that I spoke of, plus whatever portion of the \$5 million that could be used for that purpose.

Q. My question to you was, suppose the additional costs exceeded \$6 million? Where is PRDC going to get the money? A. I thought I indicated that very clearly, Mr.

Sigal, that it would come in my opinion from the member companies who, I think, would be glad to put up the additional money required.

Q. My question to you, Mr. Acker, is, is it not true that at the present time there is no commitment from anybody,

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any member of PRDC, to give one cent more than they have now committed themselves to give in these letters of commitment? A. That is perfectly true, but I would like to say that it would be most difficult to get anybody to make a commitment for an unknown amount.

[513]

By Mr. Sigal:

Q. Do you know what force that containment vessel is planned to contain? A. I am not qualified in that field, Mr. Sigal.

Q. If it should turn out, Mr. Acker, that the estimate is wrong, is it not quite possible that the entire vessel will have to be rebuilt? Obviously, if it is too weak to contain the force for which it is intended— A. If the calculations upon which the strength of the vessel was based are wrong, it might have to be rebuilt or it might have to be reinforced or an additional might have to be placed outside. Anything might happen.

Q. Are you aware that there is a serious question in this case as to what nuclear accident might have to be contained or the force of such an accident? A. Yes, I am aware of that.



Q. Hasn't PRDC gone ahead and made its plans with respect to the kind of vessel it will order without waiting for final experimental results on this question?

[514]

A. That is true. Those experimental results would be expected to confirm the theoretical calculations of the engineers and scientists who have made the assumptions on which the design was based.

The Presiding Officer: Mr. Acker, did you finish your statement?

The Witness: Yes, I did.

By Mr. Sigal:

Q. That vessel would have to be ordered and built prior to the time that those experimental results are available, won't it, Mr. Acker? A. That is right. That is one of the financial risks that we are assuming.

Q. Are you prepared to say that the members of PRDC will go so far as to pay for the complete rebuilding and redesign of the reactor in the event the experiments show serious fault in the whole structure? A. You mean just the reactor itself, or the reactor plant.

Q. I mean the whole project. Are they prepared to start from scratch to redesign and-rebuild the reactor? A. No, I am not prepared to say that, Mr. Sigal.

Q. Let me call your attention, then, Mr. Acker, to this statement which appears in the testimony of Mr. Bethe, page 56.

[515]

A. I have it, Mr. Sigal.



Q. I call your attention to the last full paragraph on page 56. I will read it.

"To measure in particular the prompt positive temperature coefficient, we shall reduce the flow of coolant to a very small amount, possibly shutting it off completely, and we shall use very low power, perhaps one percent of normal operating power. If then the power oscillation is in phase with the reactivity oscillation, this indicates a positive prompt temperature coefficient; if it has the opposite phase, then the temperature coefficient is negative. If in this experiment, contrary to what I believe will be the fact, the temperature coefficient should turn out to be positive, we shall take the reactor apart and redesign it."

Did Mr. Bethe make that statement with the authority of PRDC officials? A. I have no knowledge of on what basis he made that statement.

Q. You are not prepared to state that PRDC will take the reactor apart and redesign it if it turns out that it is so seriously defective as indicated? A. I am not prepared to state that. That would be a management decision, Mr. Sigal, obviously, which could be made only at the time and under the circumstances.

[636]

Q. Since we are on that exhibit, I would like to ask just a few more questions.

Mr. Acker, I would appreciate it if you would make one more mathematical calculation. Have you brought your

slide rule this morning? A. No, I did not, sir. It is in Poughkeepsie.

Q. We calculated the figures derived from dividing the estimated income of PRDC for plutonium sales by 106 for each year; is that right? A. That is right.

Q. We, I think, did not finish those calculations.

The figure 106 per year is taken from Intervenor's Exhibit No. 1, which shows that PRDC estimated the production would be 106 kilograms of plutonium per year; is that right? A. Yes.

Q. Now, assume that that figure 106 is an average annual production for 10 years; that would mean the total production

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for the 10 years would be 1060 kilograms; is that right? A. On that assumption, yes.

Q. On that assumption, yes.

Will you please divide the figure 48,623,000 by 1060? A. That is approximately \$46.

Q. Per gram? A. Per gram.

Q. Mr. Acker, I think you heard Mr. Morrisson, counsel for AEC, state yesterday that the price per gram of plutonium which the AEC will pay to licensees who produce it beginning July 1, 1962, will be \$12.

Mr. Chaytor: Object, your Honor. That is an incorrect statement, I believe.

Mr. Sigal: I thought that is what was said. If that is not correct, let me read to you, Mr. Acker, the release issued by AEC on this subject dated November 18, 1956:

The Witness: Yes.

By Mr. Sigal:

Q. "The Atomic Energy Commission has established guaranteed fair prices to be paid for plutonium and Uranium 233 produced in atomic reactors operated under license in the United States and delivered to the Commission for the one-year period beginning July 1, 1962.

"The prices are, for plutonium metal, \$12 per gram. For Uranium 233 nitrate, \$15 per gram of U-233.

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"These prices are based on the estimated fuel value of the materials and are identical with those to be paid for these products of reactors abroad fueled with material supplied by the United States."

A. Yes.

Mr. Sigal: I would like to call Mr. Claytor's attention to the language Mr. Morrisson used yesterday if he still has any question about it, on page 600 of the transcript:

"There is a further unclassified price of \$12 a gram which has been guaranteed from June 30, 1962 to June 30, 1963."

Mr. Claytor: That is right. I think you said after 1962. I got the impression that applies to the rest of the period.

Mr. Sigal: I had no such intention.

Mr. Claytor: Very well. It is correct now, anyway.

Mr. Morrisson: I think we should clarify the

record in one other respect, Mr. Examiner. Mr. Sigal's statement was that I said that the \$12 price was the price which the Commission would pay. That is ~~not~~ what I said. I said that is a price which has been guaranteed.

The Presiding Officer: I noticed that; yes.

Mr. Sigal: I greatly appreciate the correction. I think that is very illuminating. I think the appropriate

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argument will come at a later date as to what the significance of the difference is.

By Mr. Sigal:

Q. PRDC presumably was aware of this release at the time it was made, would you not say, Mr. Acker? That is, November 18, 1956? A. Yes. We have a copy of it.

Q. You have a copy of it? A. Yes.

Q. You stated earlier that the Exhibit XXIX which gives the estimates of income for the operating period was prepared in the latter part of December, 1956; is that right? It is dated December 31, 1956. A. That is right. But in all fairness, Mr. Sigal, we have been making studies on which these figures are based for some period before that time, a matter of months. So that some of the figures reflect considerations which were determined a long time prior to December 1956.

Q. You mean that the considerations that you had in mind in December 1956 did not include the announced price, or this announcement of AEC in November 1956?

A. They took that into consideration; yes.

Q. In so far as any calculations for the year beginning July 1, 1962 are concerned, they presumably took into consideration this announcement of AEC, did they not?

[640]

A. They certainly did.

Q. And furthermore, with respect to any calculations for the years thereafter, they took into consideration this announcement of the AEC? A. They took into consideration, Mr. Sigal, everything that we knew at that time.

Q. Everything that you knew in December of 1956? A. That is right.

[690]

Q. And at the present time you have no commitments of any kind from your member companies or banks for the contribution or loans in excess of the amounts which have previously been testified to, is that right? A. That is right.

*Cross Examination by Mr. Maslowski*

[707]

Q. There has been a considerable amount of discussion in so far as the loan guarantee is concerned, and in so far as this assistance is concerned that the members of APDA may be giving PRDC. Were there any special reasons for this kind of a setup? A. Do you mean with the two different organizations?

Q. Yes. A. Yes. The APDA group was a group interested primarily

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in research and development, and the creation of a conceptual design and study of the whole problem of the application of nuclear fission to the production of electricity, or heat that could be used for the production of electricity. The PRDC group represents such members of APDA, with several others added, who were interested in carrying the research and development work on from that point, and actually putting up their money to construct a demonstration reactor plant. It just represents a difference in the particular interests of the members of each group, bearing in mind that there are a number of companies that are common to both.

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*Cross Examination by Mr. Morrisson*

[729]

Q. As I understand your testimony of the other day, Mr. Acker, you indicated that the contingencies in general are not intended to cover design changes. Is this correct?

A. That is my understanding.

Q. What provision, then, have you made to cover the cost of possible alterations in the designs of the reactor plant? A. To cover the alterations, the cost of the redesign, or of the equipment that might have to be substituted for something already purchased?

Q. Let's cover it both ways. First of all, the possibility

that design changes may be made prior to the time the equipment is ordered, which increases its cost; secondly, the possibility that design changes may be made after equipment has been obtained so that it is necessary to scrap that equipment and substitute something else. A. We have discussed before in this proceeding the

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\$5 million allowance that we have in the PRDC over-all cost estimate for research and development work. I would think that design changes would be covered by that item. You will remember that there is an aggregate of \$142,000 of contracts allocated to that item to date. In addition, the amount at which we have the test equipment and devices to be received from APDA, included in our cost estimate the approximately \$4.1 million, whereas, in our financial figures, we have taken that in at only \$3 million. So the difference would be available in our resources to take care of equipment changes. I would think that the \$5 million would be available for design, and approximately \$1 million would be available for changes in equipment. If either or both items were not sufficient to take care of modification of plant equipment, we would expect that our member companies would be glad to put up whatever additional amount were required. There are, however, no commitments on their part to do so.

Q. I want to come back to that in a moment. Let me ask you this: Is the \$5 million intended as a provision for increased procurement costs that might result from design changes, or increase in construction cost? A. No, it is not. It could be, if there were any available, but



that is not the intent of the item in the construction estimate. It is for research and development, re-design, anything of that kind.

[731]

Q. And there are a number of, at least, possibilities in which additional research and development might be found necessary? A. That is right.

Q. Let me inquire a little more about this \$1 million item which, as I understand, is the difference between the \$4.1 million, in which there is included in the construction estimate the cost of those components which APDA will procure, and the \$3 million which is charged as APDA's contribution to the project. Is that a correct explanation?

A. Right.

Q. Exhibit XXI to the license application, or suppose I call it license Exhibit XXI—

The Presiding Officer: To distinguish it from Acker?

Mr. Morrisson: Yes.

By Mr. Morrisson:

Q. That is the agreement between PRDC and APDA?

A. That is right.

Q. Article 1-B of that agreement states, does it not, that the equipment and devices referred to in that article will be transferred on a where-is, as-is basis, and APDA will be compensated therefor on the basis of the salvage value of such equipment and devices as determined by agreement. Is not this \$1.1 million, then, an amount which PRDC



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is obligated to pay to APDA in compensation for the equipment and devices which APDA will transfer? A. No. In connection with the salvage value, discussions between APDA and PRDC fix the basis on which the salvage value will be calculated, and it has been agreed that it would be the scrap value of the metal involved in the APDA test facilities and devices. Based on calculations as to the quantities of various classes of metal involved and the scrap values of such metals, the salvage value, for purpose of calculation at this time, is indicated at about \$55,000.

Q. Where does that appear in the cost of construction that PRDC would pay? A. I don't think it appears, Mr. Morrisson.

Q. This is not a final agreement as to the salvage value, but it is the present basis of the discussion? A. That is our estimate of what it would be at this time, that is right.

Q. Then is not the actual contribution made by APDA to this project, that is, in addition to the \$4 million which it is to put up for research and development, is not its actual contribution the difference between \$4.1 million, which it will pay for these components, and the \$55,000 which it will receive for them? A. I would say that was a fair statement.

Q. This is the amount that APDA will be out-of-pocket in connection with its participation in the construction

[733]

of this component test facility? A. Yes. If its costs are in accordance with our estimates and our own cost estimate.

[761]

Q. Has the management of PRDC considered the magnitude and cost of these possible changes and made any determinations as to whether the financial arrangements which they have made will be adequate to take care of this sort of change? A. I am really glad to have the opportunity to clarify our position on that matter, Mr. Morrisson. I believe I testified previously in answer to Mr. Sigal's question somewhat along the same line to the effect that when we were

[762]

faced with whatever recommendations we might have from Dr. Bethe in particular it would be a management decision at the time depending on the circumstances. I was thinking as the chairman of the finance committee of PRDC at that time principally in the financial concept. So far as the safety features of this reactor are concerned, it is the full intent of the management of PRDC to accept and abide by the recommendations of its consultants, its nuclear experts in this field and in particular and specifically, if you will, Dr. Bethe. I can not conceive that the management of PREC would go forward with this project if there were any question by their own consultants as to the safety of the reactor, and of course it is obvious that the reactor can not be operated without a license from the AEC, and it is my understanding that they, too, have to be satisfied as to the safety of the reactor.

As against the possibility of changes having to be made in connection with the recommendations of our consultants, I will say that we do not have the complete financial situation that we might be faced with covered by firm commit-

ments at this time, but I express my own opinion, as a result of discussions with my associates in this project, that having gone forward to the extent that we have in financing this project and with the interest that we have in its completion, I have every confidence that these companies will put up the additional funds necessary to take care of whatever adjustments,

[763]

changes, modifications are required.

Q. You say this is your opinion based on discussions with your associates. Has this matter specifically been discussed with the member companies? A. We have had many discussions, Mr. Morrison, as to the future possibilities in connection with modifications and changes of this reactor plant.

\* \* \*

[778]

Q. This comes to a question I was going to take up with you anyhow. On the table that shows the calculation of steam revenue you have shown an increase in net plant capability starting from about 103,000 kilowatts in 1961 and increasing to 155,000 in 1966, and subsequent years? A. Right.

Q. This corresponds, I take it, to a similar increase in the table entitled "Calculation of Plutonium Reserves," it says here, but I think that should be "Revenue", should it not? A. Where is that reference?

Q. There is a small sheet as part of Acker Exhibit No. 10 entitled "Calculation of Plutonium Reserves." I believe the word should be "Revenue" rather than "Re-

serves." These pages are not numbered so I can't identify it more directly than that.

That shows an increase in reactor power level expressed in megawatts of heat running from 300 in 1960 up to 430 by 1966, and subsequent years.

[779]

A. That is true, Mr. Morrisson. I would like to call attention to the fact that quantities of plutonium produced are omitted from this exhibit in as much as they would lead to possible calculations from which the price schedule for the plutonium could be derived. Again, the assumption on which we have based our plutonium revenues is that the current classified schedule will continue in effect throughout the operating period.

Q. I was asking you at the moment only about the reactor power level and the change in that power level which is shown on these two exhibits. A. I would like just to clarify what I said a little further, and that is that my understanding is that the present price schedule for plutonium provides for different prices for different qualities of plutonium. The price announced for the period beginning June 1, I think it is, or July 1, 1962 through July 1, 1963, is published as a base price, and our plutonium revenue figures are based on the assumption that there would be different prices available during that year and thereafter for different qualities of plutonium.

The Presiding Officer: Should that exhibit be corrected so the word "reserve" is changed to "revenue"?

Mr. Claytor: I think we should note on the record that the heading of the sheet entitled "Calcula-

tion of Plutonium Reserve" in Acker Exhibit No. 10 for identification

[780]

should read "Calculation of Plutonium Revenue", not "Calculation of Plutonium Réserve."

The Presiding Officer: Very well, the amendment may be made.

Mr. Morrisson: Thank you.

[781]

Q. Does this manning table cover the personnel requirements for the entire plant which will be operated by PRDC? Let me clarify my question. In APDA 115 which is in

[782]

the record as an exhibit to the license application—

Mr. Claytor: Exhibit X-A to the License application.

Mr. Morrisson: On page 106 there is a plot plan of the plant which shows various structures, the reactor building itself; the steam generator house, the central house for electrical equipment, the sodium and gas building, the service building, a building for decay storage, a sewage plant, holdup tanks for waste disposal, railroad tracks and various other things of that kind. This manning table represents, does it, the personnel force required to maintain and operate all of these buildings and the associated grounds?

A. That is true.

Q. If you will come back to the figures on steam and plutonium revenue, on the steam revenue figure you have projected here an availability factor which starts at 40 per cent and rises ultimately to 80 per cent. A. That is right.

Q. How does this compare with a plant availability factor on a new conventional generating plant? A. It would depend greatly, of course, on the use to which the plant was put, whether it was a base load plant or was being used as a peak load carrier.

Q. Let us assume a base load plant. A. On the average I would say that the availability

[783]

factor might be considerably higher for a conventional steam plant than the ultimate figure of 80 per cent which we have projected.

Q. Higher than the ultimate figure of 80 per cent? A. That is right.

Q. In the initial years what sort of availability figure would you assume on a conventional plant? A. It would be very much higher if you could fit it in to the base load of the company.

Q. Assuming you could use the power? A. Yes.

Q. In your situation here Detroit Edison is obligated, is it not, to buy whatever steam the plant produces whether or not Detroit Edison can use that steam? A. That is right.

Q. So there is no problem of fitting it into a load, the plant will sell whatever steam it can produce? A. That is right.

Q. This factor is therefore a factor which reflects your

judgment as to what is now a reasonable estimate of what the plant can produce? A. That is right, and one factor of the rate paid by Detroit Edison takes into account the availability of the plant.

Q. This is quite an uncertain item, is it not, at the

[784]

present stage of development of the plant? A. Yes, it is.

Q. In other words, the actual availability could be substantially higher than you have shown here? A. It could be higher or lower.

Q. Or it could be lower? A. That is correct.

Q. I note that the steam agreement, which is one of the exhibits to the license application here, Exhibit XXV on page 11, in paragraph numbered D, states that "In view of the experimental nature of the project of the company extended shutdowns of reactor plant may be required in addition to regularly scheduled shutdowns for nuclear material loading and for maintenance."

Have you taken that possibility into account in projecting this availability factor of the plant? A. We have to the extent that they can be taken into account with the knowledge that we presently have before us, Mr. Morrisson.

Q. Is it your assumption that these shutdowns are more likely to occur in the early period than in the later period of operation? A. I would think so, or during the middle period of operation.

Q. This is perhaps a detail, but just as a matter of

[785]

interest why is it that the availability factor is shown at a lower figure in 1967 than in 1966? A. That is because of



allowance being made for scheduled shutdown for a part of that year.

Q. A scheduled shutdown for what purpose? A. For general overhaul and maintenance.

Q. I see. Is that the only such general scheduled shutdown that you have allowed for or are there others? A. I can not say in detail, Mr. Morrisson, but I would say that there is provision in these assumptions of availability factor for incidental shutdowns from time to time. This is a scheduled proposed shutdown.

Q. Now if you will turn to the table entitled "Calculation of Plutonium Revenue" you have testified, have you not, that these revenues are based on the assumption that certain prices which have been guaranteed for a limited period of years will continue applicable throughout the operating period of this reactor? A. That is right, Mr. Morrisson.

Q. This is only an assumption, is it not? A. That is a pure assumption.

Q. So the actual revenue figures could differ substantially from those shown on this chart, depending on whether that assumption turns out to be valid? A. That is true.

[786]

Q. These figures are also based on certain assumptions as to plutonium production, and you have explained that the detail figures on plutonium production can not be given here. A. That is right.

Q. My question, however, is, given the present state of knowledge about the reactor, do you believe it is possible to estimate now with a high degree of reliability what the quantities of plutonium production will be, or is this also



a factor which is subject to a considerable range of uncertainty? A. No, Mr. Morrisson, I am advised by our staff and consultants that on the basis of specific assumptions as to power levels, and so forth, the production of plutonium can be accurately estimated.

Q. But this does depend upon specific assumptions as to power? A. That is right.

Q. This reactor has not yet been built. Can you say with assurance that it will achieve 100 electrical kilowatts of power equivalent or that it will not achieve more than 150?

A. No, I don't think that I can say that specifically for myself. Any statements made, any assumptions made, are based on theoretical calculations of our staff and consultants.

[787]

Q. In other words, these assumptions are based on the best information available to you at the present time?

A. That is right.

Q. But any projection as to the physical fact with respect to the operation of this reactor in terms of the power it will achieve, the quantities of plutonium it will produce, the quantities of steam it will produce, are all merely estimates at this point based on the projected operation of a plant which has not yet been built? A. Yes.

Q. Besides which there is not much operating experience of this character? A. I believe you could say, Mr. Morrisson, if the assumptions are sound, the results can be accurately calculated.

Q. Yes, I understand that. The same observation may be true with respect to the quantities of material

which will have to be submitted for chemical processing and therefore the cost of chemical processing, is it not?

A. Yes, that is very true.

Q. Can you tell me whether the data on which this table was based assume a reloading cycle under which the plant will be shut down for reloading once a week or whether they assume a change in that reloading cycle? A. I am not competent to testify as to the projected

[788]

reloading cycle, Mr. Morrisson.

Q. Who would be competent on that? A. Mr. Amorosi.

Q. Then if I can summarize a little bit the picture on the operating side we have identified a number of kinds of uncertainties with respect to the operating costs and revenues of the plant, and when I use the word "uncertainty", Mr. Acker, I don't use it in any critical sense. I am simply trying to point out that in the state of our knowledge, with this being frankly an experimental plant it simply is not humanly possible to project these costs and revenues with the degree of assurance that one might have with a conventional plant. Isn't that so? A. That is certainly true. The very reason for the construction and proposed operation of this plant, Mr. Morrisson, is to remove these uncertainties.

Q. Your purpose in building the plant is to find out what these figures will be? A. Exactly.

Q. That is right. We have identified a number of factors of this kind as to which, while you have estimates which you believe to be as valid as you can make them, there are elements of uncertainty. Perhaps we could classify those into two types. One type concerns the physical

facts of operation of the plant, what power loads will be achieved, what burnup

[789]

it will achieve, what quantities of plutonium it will produce, what quantities of material will have to be processed chemically, and the like. This is one area where there are some uncertainties. A. That is very true.

Q. Another area to which we have referred concerns the prices which you will be charged or will pay for certain of these things, including the price for plutonium which is guaranteed for a limited period, including also, I believe—and correct me if I am wrong—the cost for chemical processing as to which you have a proposal covering the period up to 1967, I believe. A. That is right.

Q. And incidentally, that proposal itself indicates that there may be some adjustments, does it not? A. That is right.

Q. Finally, there are use charges which are computed on the basis of a Commission price for uranium which also is not a guaranteed price throughout the period of operation? A. That is true.

Q. Perhaps when I was talking about the physical facts I might have mentioned also the manpower requirements, some of which also will have to be firmed up following the submission of more detailed information on some of the operating procedures of the plant.

[790]

A. That is right.

Q. So there are these kinds of areas as to which precise prediction is difficult at the present time? A. That is very true.

Q. What you have attempted to do, as I understand this, is to give your best estimate based on present information, recognizing that the actual outcome might be very different, that it might be more favorable or less favorable? A. That is perfectly true. We are up against the same thing that we would be up against at the start or beginning of any commercial enterprise. The areas of uncertainty here are greater, however.

Q. Has there been discussion by the management of PRDC or with the member companies as to what your situation would be during the operating period should you fail to receive the revenue which you have projected on the schedules or should your costs exceed those which have been projected on these schedules? A. There has been no specific discussion to that effect.

Q. Has there been recognition of the possibility that

[791]

conditions could be such that the operation of the plant would result in a net cash deficit? A. Oh, yes.

Mr. Sigal: Mr. Examiner, I think there is a limit to the extent to which this kind of question should go. Mr. Acker said in response to the previous question there had been no discussions. That seems to me to settle that question. Now Mr. Morrisson goes on and asks for recognition. What does that mean? The look in somebody's eye? There have been a lot of questions like this by Mr. Morrisson indicating the kind of answers that are desired, and it is no satisfactory explanation to say that this is cross examination.

Mr. Morrisson: Mr. Examiner, I have asked my question and it has been answered. I don't think there is a question outstanding unanswered.

The Presiding Officer: Very well. You may proceed, Mr. Morrisson:

By Mr. Morrisson:

Q. Have you computed, Mr. Acker, the values of the inventory of source and special nuclear material which will be in the possession of PRDC or under its custody and control during the operating period? A. Yes, those figures are available.

Q. I don't think they appear on any of these exhibits, although I think they can be determined by computation from

[792]

the figures which you have given for either the use charge or the value of its waiver? A. I think you are right, Mr. Morrisson. I think they appear for the years during which the use charge would be applicable assuming that the waiver of the use charge would be made.

Q. I think you gave a quantity in kilograms but not a value. Let me get it at this way: It is my understanding that the value of the inventory during most of the operating period from 1961 on would range somewhere between 16 and 18 million dollars. A. I believe that is correct.

Q. Is that substantially correct? A. Yes.

Q. What provision have you made or do you anticipate making to reimburse the Atomic Energy Commission in the event that this inventory or part of it were destroyed or rendered unusable? A. I can't say that any

specific provision has been made, but I would like to call attention to the fact that some of the member companies of PRDC have guaranteed the bank loan of \$15 million. If there were financial obligations of PRDC which would not permit it to take care of all of its operating costs, such costs as you indicate and also service its debt, the member companies would be called

[793]

upon to make good on such guarantees. So in effect we have a reserve of \$15 million for contingencies not reflected in these figures which could be used as against any additional costs that are not reflected here.

In other words, if our operating expenses were so much higher than are indicated here or some other element of cost such as you suggest entered into our operating cost we would be in the position of possibly not being able to take care of the repaying of our debt. In that event we could call upon our member companies to take care of the repayment of the debt, and to the extent that we have provided for it in these estimates such funds would be available to meet other operating costs.

Q. You will be paying off principal on the long-term bank loans, will you not, at the rate of \$2 million a year beginning with 1964? A. That is right, and I think it is a higher figure in the last year.

Q. With a higher figure the last year, that is right. To the extent that that principal is paid off the member companies will have been relieved of the obligation under their guarantee? A. That is right.

Q. So by the beginning of 1970 their aggregate obligation will be only \$3 million and not \$15 million?

[794]

A. Yes. That is a very excellent point. It is a decreasing reserve, in other words, Mr. Morrisson.

Q. I again ask you, sir, supposing something untoward should happen which resulted in the destruction or in rendering unusable this inventory of special nuclear material in the year 1970; what provision would be made to take care of the obligation to the Commission for the charge for this loss of material? A. I can not say at this time, Mr. Morrisson. That is something I would like to discuss with my associates. I think it is a condition we would have to meet at the time, depending upon the circumstances at the time.

Q. You are aware, are you not, that one of the Commission charges for special nuclear material under Section 70.23 of the regulations is a charge for the use, consumption or loss of the material? A. Yes, so I understand.

Q. So as the testimony stands at present you do not know what provision the company has made to meet this charge should it arise? A. Not in the event of the loss or destruction of a substantial portion of the inventory.

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[826]

By Mr. Morrisson:

Q. Mr. Acker, I would like to come back once again to the question which we were discussing before as to the possibilities that might arise here either that the construction estimates will be exceeded or that the operating



situation will be less favorable than it has been shown to be on these various exhibits which have been submitted. I think we agreed that there are some possibilities that either of these events might occur. A. I think there are possibilities.

Q. Can you tell me as specifically as you are able to, what discussions have been had with the member companies with respect to the possible demands that might be made on them for additional contributions? A. Mr. Morrisson, all of the people who are involved in this project representing their individual member companies are corporation executives. They deal every day with the possibilities of things that may happen in the future. They have to project their businesses into the future to determine what additional financial support they have to get, what their operating results may be, whether they can support the additional investment which must be made in the business. We are all aware of the fact that this is a more difficult field in which to prognosticate the future than the field in which we are doing business. We have many times discussed the possi-

[827]

bilities that there may be additional demands made on us, but nobody has made any commitment as to what he would do under those circumstances. That is a contingency which we expect to meet when it arises, and my own personal conviction is that this group will go forward in support of this project and see it through to completion.



*Re-cross Examination by Mr. Sigal*

[841]

Q. No, no. I didn't make my statement clear. I said that your calculation was based on several assumptions. I will say your calculation was based on several considerations, one of which was the current price paid for plutonium, a second one of which was this \$12 guaranteed price of January 1, 1962. Do you recall that testimony?

A. I do not, Mr. Sigal. I think whenever I talked about our estimates of plutonium revenues I have always said

[842]

that our assumption and our only assumption was that the current price schedule which is now classified would be maintained and available to us throughout the entire ten-year operating period.

[843]

Q. Then please explain your position, Mr. Acker. A. I have said several times that our assumption was that the present schedule of plutonium prices, classified, would remain in effect and would be available to us during the ten-year operating period.

Q. You made that assumption in December 1956? A. Yes.

Q. Although you knew at that time that AEC had made an announcement to the effect that the guaranteed price for plutonium after July 1, 1962 would be \$12 per gram, is that right? A. That is right, Mr. Sigal.

Q. What reason did you have to believe that PRDC would receive a sum different than the \$12 guaranteed price after July 1, 1962? A. We had no reason to believe that that can be demonstrated. That is an assumption, as I said originally, that we made.

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[849]

Q. Did you discuss with any individual member of PRDC what such member would do in the event the funds committed or guaranteed for PRDC would not be sufficient to meet its expenses? A. Yes. I discussed it with many of them.

Q. Can you name the individuals with whom you discussed it and the nature of the conversation? A. I think if you will look at the names of the members, the trustees of PRDC, that would be my answer.

Q. You discussed it with every one of them?

[850]

A. I have discussed it with them as a group. I have discussed it with many of them individually.

Q. Was there any conclusion drawn on the question of what they would do in the event there was not enough money to meet the obligations of PRDC over and above the contributions and the guarantees? A. None whatsoever, but I felt it my duty as chairman of the financial committee, Mr. Sigal, to point out to them this possibility. The schedules themselves show need for temporary loans, and they are all on notice that we may ask them to advance funds to take care of such temporary borrowing.

- Q. But none of them said to you what he would do?  
 A. None of them made any commitment whatsoever.

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HANS A. BETHE

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[1145]

*Cross Examination by Mr. Sigal*

- Q. Dr. Bethe, I call your attention to the following colloquy between Mr. Cannon, Chairman of the Appropriations Committee, and Mr. Strauss, Chairman of AEC, which appears

[1146]

in the same volume at page 239. A. Yes, I have that.

- Q. In order to get the context, I would like to read Mr. Cannon's statement first:

"Let me ask this. We discussed yesterday in exhaustive detail the roadblocks and bottlenecks in the negotiations in order to get Detroit Edison into construction of this fast breeder reactor. Here is another cause for delay, and it was not mentioned to us. I cannot understand why it was not mentioned to the committee when we were discussing these other causes for delay. Furthermore, we discussed yesterday the danger connected with the possibility of these plants getting out of control. We discussed that in detail, and still we are not told what was the cause for failure to approve designs of this plant.

that we are so anxious to get along with. Why was this not mentioned to us, Mr. Chairman?

"Mr. Strauss: It was. It was stated that this fast breeder was the most hazardous of all the reactors."

Do you have any comment on the statement of Mr. Strauss?

Mr. Claytor: I object to a question of "Do you have any comment on a statement".

The Presiding Officer: I think so, Mr. Sigal. I will sustain the objection.

[1147]

By Mr. Sigal:

Q. In the light of these statements, Dr. Bethe, are you inclined to make any change in the testimony that you gave with respect to the hazards of a fast reactor? A. No, I am not inclined to make any changes. I did mention in my written testimony various areas in which special investigations are needed for the safety of fast reactors. Similarly the Safeguards Committee letter of June 6 mentions various areas. These are essentially identical. Obviously there are areas which require special attention. Obviously these areas have to be dealt with, although I have no knowledge whether this is so, I presume the gentlemen who have made such comments as you mentioned have in mind that these various areas have to be cleared up in detail.

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KENNETH E. FIELDS

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[2705]

*Cross Examination by Mr. Sigal*

By Mr. Sigal:

Q. I was going to get to the second point of that answer, Mr. Fields. Aside from any published regulations, are there any kind of standards, criteria, considerations, published or unpublished, which the AEC has established to assist in determining whether or not an applicant is financially qualified to engage in the proposed activities? A. I have a problem on that question, on informally. I don't see how a standard could be established if it is informal. We will use our judgment on the financial qualifications in line with this particular regulation. Now whether this is informal or how you term this, I presume that we will do so on the basis of this record, using our best judgment and opinion as it is developed in this hearing, and to set these matters down as a regulation I doubt whether one could do this in too great detail. One will always rely on judgment in arriving at these findings and determinations on this point.

But in any event, insofar as I know, there are no other regulations by which we currently have in hand to make this determination.

Q. Then I gather you also stated there are no written criteria, whether in regulation form or otherwise, which would be applied by the Commission in determining financial qualifications of applicants.

[2706]

A. I am not aware of any; no.

Q. In regard to section 50.60(C)(2), which I mentioned

earlier, that section states that in order to obtain approval of the Commission of an application, the applicant be financially qualified to assume responsibility for the payment of Commission charges for special nuclear material, and to undertake and carry out the special use of the nuclear material for a reasonable time.

What standards, if any, has AEC established in order to determine the financial qualifications of an applicant under this section? A. Here again I believe the answer is the same. I am not aware of a written, published or otherwise set forth standard for judging this. It is again a review of the specific license application and the judgment issued at the time as to the qualifications.

Q. When you say at the time, you mean at the time that the license is issued? Is that what you mean? Or at the time the application is considered? A. It may be a judgment then or when the actual transfer of the material is to take place; yes.

Q. Are you finished with your answer? A. Yes, I have finished.

Q. Then with respect to the time of the determination, you say that with respect to the transfer of nuclear materials,

[2707]

the determination will be made and the criteria established either at the time the application is considered or at the time the nuclear material is transferred.

. . .

[2743]

By Mr. Sigal:

Q. Certainly it is true, is it not, that AEC has not es-

established any guaranteed price for plutonium based on its fuel value for the period after June 30, 1963. A. That is correct.

Q. Now, Mr. Fields— A. Could I put something on this further point to clarify my previous answer?

Q. Surely. Go ahead. A. I think the record should show that this belief on my part as to where the value of plutonium may go does not rest alone on any technical knowledge I have, of the nuclear fuel processes. Essentially this is not a belief based on any technical qualifications I have as a nuclear scientist or nuclear engineer, but on the belief that if it proves to be of value in nuclear power plants that there will be many other factors that determine the value in relation to other materials as well.

Q. Assume that the record shows, Mr. Fields, that if PRDC receives only \$12 per gram for the plutonium which it expects to produce in this reactor it will be many millions of dollars short of the income it needs to operate the reactor, does AEC have any criterion applicable to this circumstance for the purpose of determining whether or not PRDC is financially qualified to operate the reactor?

[2744]

Mr. Morrisson: Objection.

Mr. Sigal: This is an entirely different matter from what we considered before.

Mr. Morrisson: It still goes to the question whether there are any criteria on the issues of financial qualification other than those already set forth in the published regulations of the Commission. That has been answered many times.



Mr. Sigal: I would like to have an answer for the record.

The Presiding Officer: I think he will testify that there is no criterion outside of those published in the Federal Register.

The Witness: That is true.

[2753]

Q. Is there any agreement or arrangement of any kind between AEC and PRDC relating to the charges which AEC will make for the use of special nuclear materials after June 30, 1960? A. Just a minute. The charges we will make to PRDC for the use of special nuclear material?

Q. Specifically for the uranium which you will deliver to PRDC. A. There is a provision in the contract that waives the use charge for five years, I believe, of the operation of the plant, after a license is issued to operate.

You are perhaps not referring to this?

[2754]

Q. I want to make it clear. I am asking now for the period after the period of the waiver. A. I know of no agreement for anything beyond what is in the contract on that waiver provision.

Q. The contract makes a provision for the waiver of use charges? A. Yes.

Q. For the first five years after the license is granted?

A. Yes.

C. ROGERS McCULLOUGH

[2999]

*Cross Examination by Mr. Morrisson*

Q. Dr. McCullough, there has been a great deal of discussion in this proceeding about the whole problem of evaluation of reactor hazards, the special techniques and special problems which have been presented by such evaluation.

I would like to include in the record a statement of your general views on these questions of hazard evaluations, and for that purpose I would like you to look at the transcript of the hearings before the Joint Committee on Atomic Energy on Governmental Indemnity for Private Licensees and AEC Contractors Against Reactor Hazards, at pages 47 and 48, the passage that I have marked, and ask you if you still agree with the views expressed in that passage?

[3000]

Mr. Morrisson: If he says that he does, Mr. Examiner, then I would like to have that passage read into the record as a portion of Dr. McCullough's testimony, rather than take the time of asking specific questions addressed to this point, because I think it well expresses the point I am trying to get at.

The Presiding Officer: Very well.

Mr. Morrisson: For reference, I am starting at the middle of page 47 and carrying through to the second full paragraph on page 48.

The Witness: Do you wish me to read this to myself?

The Presiding Officer: Yes, sir.

Mr. Morrisson: Just to be sure that you concur now in the views expressed in that passage.

The Witness: I accept this.

The Presiding Officer: Let Mr. Maslowski see it, please.

In order to save time, the statement may be incorporated in the record at this point, if that is agreeable with you, Mr. Morrisson.

Mr. Morrisson: Yes, Mr. Examiner.

(The information referred to is as follows:)

"Dr. McCullough: I think this is the right attitude, sir.

[3001]

"Care must be taken to insure that there is a low probability of accidents with nuclear reactors because these machines store fission products. I think it is worth reiterating that these products are more toxic per unit weight than any other industrially known materials by a factor of a million to a billion. It depends on what standards you take. If these materials should be permitted to escape there is a possible hazard to large numbers of people and many square miles of territory.

"Because of this possibility of a major disaster, even though it has a low probability, it is justifiable to take unusual precautions that the design, construction, and operation are sufficiently conservative.

"I think it is worth while pointing out that for

the first time in any major industrial development an attempt is being made to foresee the possible accidents or disasters, and to take positive steps to prevent them. The introduction of this new philosophy poses difficult problems. But because of the potential hazard to people, and even future generations, it is imperative to face and solve these problems.

"It should be made clear that the hazards associated with nuclear reactors or any other peaceful application of atomic energy are related to the highly toxic

### [3902]

radioactive materials which are generated.

"These facilities that we are talking about do not have an explosion hazard in the sense of a possible detonation which would devastate large areas by blast or heat effect.

"The nuclear reaction is an extremely dynamic one. A nuclear reactor can increase in power level thousands of times in a fraction of a second if it is improperly designed and controlled. There is no other machine that I am aware of that has this possibility of such sudden changes in energy output.

"As a result, fuel elements, control elements, and the structure of the reactor itself can be melted or even vaporized if a nuclear runaway accident should happen. By the proper careful design and the inclusion of reliable controls and safety devices,

it is believed that nuclear runaways can be prevented or, at least, reduced to a very low probability.

"One must recognize that the best known devices are not infallible. Even such well-known things as railroad rails break, turbine shafts shatter, trolley wheels come off and locomotive braking systems fail. One must admit that there is always a possibility that a reactor accident can occur.

"The dynamics of a nuclear reactor are such that

[3003]

if a nuclear runaway is once started no human being can respond rapidly enough to stop it. However, reactors can be designed to be self-limiting. Precautions in maintenance and operation can be taken. The reactor thus can be prevented, in all probability, from ever starting a nuclear runaway."

\* \* \*

MARK MILLS

\* \* \*

[3278]

*Cross Examination by Mr. Sigal*

Q. Do you see anything urgent so far as either the nuclear aspects are concerned or the social aspects are concerned that this schedule be adhered to. A. I have a feeling this is really outside of my competence, but let me answer a little bit indirectly. Practically all advanced technological developments take place with a sort of combined

construction and research and development and necessary dovetailing of these things and it seems to me that just how this is done really pretty much has to be left up to the people doing it. They are the ones who can see the best ways to schedule different parts of the job in view of development information they see coming along that will influence, in view of the fact some parts of it are not sensitive to the kinds of information that they believe is likely to be developed and pertinent and so on.

[3285]

Mr. Morrisson: Mr. Radley, will you take the stand, please.

H. MONROE RADLEY was called as a witness and having been first duly sworn, was examined and testified as follows:

*Direct Examination by Mr. Morrisson*

Q. Will you state your name and address for the record? A. H. Monroe Radley, 3701 R Street, N. W., Washington, D. C.

Q. Are you the H. Monroe Radley who prepared narrative testimony consisting of nine pages which was recently filed in the proceeding? A. I am.

Q. Mr. Radley, will you look at page 2 of that testimony on the first line. It states "From 1942 to 1948 I was an engineer" and so forth. Are those dates correct? A. That should be 1943.

Q. 1943 to 1948? A. That is correct.

Mr. Morrisson: Mr. Examiner, the date was

changed in ink on the copy that was filed with the reporter this

[3286]

morning. I neglected to call attention to it at that time.

The Presiding Officer: Perfectly all right.

Mr. Morrisson: That is all I have.

The Presiding Officer: Very well. Mr. Sigal, you may cross examine.

*Cross Examination by Mr. Sigal*

Q. Mr. Radley, on page 6 of your statement, you say that PRDC appears to you to have under estimated the cost of on site labor. A. Yes, that is true.

Q. You give your reasons for your conclusion. Can you give us some statement of the order of magnitude of the under estimation of that labor cost? A. I think that is where a considerable portion of the overrun is found.

Q. The present estimate of on site labor is about \$3 million, isn't it? A. I believe it is \$5 million.

Q. I am sorry, yes. A. \$5,235,000.

Q. In your view it is an under estimate by some substantial figure? A. Yes.

Q. Is it two million, three million?

[3287]

A. I am not prepared to say the exact amount.

Q. But nevertheless it is substantial with reference to the total amount of the estimate of on site labor. A. Yes, that is true.



Q. And you point out that your conclusion is based on the ratio of on site labor to total labor cost as shown by the construction of similar projects by AEC. How many projects are you familiar with in the AEC program? A. You mean reactor projects?

Q. Yes. A. I have all construction program.

Q. I see. In so far as the rest of your entire experience with AEC is concerned, both general construction and construction of reactors, what does your experience show with reference to the ratio of on site labor cost to total construction cost? A. Let me put it this way. Here we have a ratio of \$18,233,000 for material and \$5,235,000 for labor. Usually the labor portion will run much higher than that on projects of this type.

Q. You have a ratio here of say 18 to 5. A. Yes.

Q. Can you give us the ratio that you found to be the case in your construction experience otherwise? A. Sometimes it runs as high as six to four or

[3288]

something like that.

Q. That is six for total construction cost to four for on site labor? A. Yes. This depends on how the accounting is carried on. Different construction firms and estimators carry on accounting in different manners. So that one can't be too precise about these ratios.

Mr. Claytor: Excuse me, Mr. Sigal. You said we were talking about a ratio of six to four, and I think the record is quite unclear as to whether we are talking about six material to four labor.

The Witness: Yes.

Mr. Claytor: Or six total to four labor. It was

used one way one time, and another.

The Witness: Six material to four labor.

By Mr. Sigal:

Q. Would you say this ratio of six to four would be most common in your experience with AEC? A. I would prefer to say it is not unusual. A lot depends, as I said, on how the accounting is carried on. I really could not say that there was any real average.

The Presiding Officer: Does that include the indirect labor, too?

The Witness: The indirect labor down here is in item J on this estimate. This is just straight direct labor cost

[3289]

versus material.

By Mr. Sigal:

Q. You stated on page 7 that not a sufficient amount has been allocated to indirect and overhead expenses in connection with the construction of this project. You point out that the company has allocated \$3 million to cover these expenses.

Can you give us some indication of how much more than the \$3 million would be required for this in your opinion? A. Very often ratios of 20 or 25 per cent are shown for that item.

Q. What is the relationship? A. Let me clarify that. The total labor and material in this case amounts to \$23,468,000. Very often the indirect and overhead costs will be shown as 20 per cent or 25 per cent, something like that, depending on how these things are defined.

Q. Taking the figure of \$23 million as shown here, the overhead and indirect expenses on the basis of your experience would run somewhere between four and five million dollars, rather than \$3 million? A. In many estimates it does.

Q. You state in the next paragraph on page 7 that the estimated cost of engineering and design expenses as shown by

[3290]

the company's estimate is \$900,000, and you feel that the estimate should be at least twice as high as the figure used by the company. What do you base your conclusion on? A. Upon engineering costs that have been reported on our projects.

Q. Is there a usual percentage of engineering cost with relation to total construction cost? A. I quite often use 15 per cent.

Q. Was that based on your experience with government projects? A. Yes, that is true.

Q. So if that formula were applied in this case, you would take 15 per cent of \$32 million or roughly \$5 million? A. The base on which you would apply the 15 per cent would be less than that. You would use the construction costs. The \$32 million includes taxes and some other things like that.

Q. So what you would relate that to, then, if you exclude the taxes, it would come to about \$28 million, wouldn't it? A. I would have to add some of these items on page 5. I don't know just what the total would be. One might say roughly \$27 or \$28 million.

Q. Let us assume it is \$28 million. Then the engineer-

ing cost according to your estimate would be over \$4 million.

[3291]

A. Using this figure that I often use, yes.

Q. I say using the figure of 15 per cent. A. Yes, but I don't want to say that is my estimate for this project.

Q. You say your estimate for this project is at least \$1,800,000. A. At least \$1,800,000, yes.

Q. At least that. You also say, however, that it is common on government projects with which you are familiar to find that the engineering costs run about 15 per cent of the actual construction cost. A. That is true. The way we carry on our accounting, that is. PRDC may do it differently and that may not apply to PRDC specifically.

The Presiding Officer: How much have they spent already?

The Witness: I don't know. Not too much so far, I don't believe.

The Presiding Officer: I thought it was more than \$900,000. Is that figure available?

Mr. Claytor: How much PRDC has already paid to the architect-engineer?

The Presiding Officer: No, how much they have spent for the cost of engineering design and expenses.

Mr. Claytor: I don't believe that figure is yet in

[3292]

evidence.

The Presiding Officer: That is the reason I am asking the question.

Mr. Claytor: I don't believe it is. You mean do we have it. We certainly don't have it right here.

The Presiding Officer: Why don't you dig it out and let us find out what that figure is, if you will? Apparently, Mr. Claytor, this witness does not know, but I would like to have the figure in the record.

By Mr. Sigal:

Q. You point out further on this same page, Mr. Radley, that the company has estimated its waste disposal system at a cost of \$34,500. Are you in any position to estimate the cost of a waste disposal system for a reactor of the PRDC type and size? A. Not in a very good position.

Q. Do you think there is anything in the record justifying the company's estimate of \$34,500? A. I am sure that is too low.

Q. What experience is there available to anybody with reference to the cost of waste disposal system for a reactor—a nuclear reactor? A. You mean a reactor of this type using sodium?

Q. Of this type or any type. Who would have the experience?

[3293]

A. We have experience on water systems.

Q. Does anybody have any experience on sodium systems? A. I think it is somewhat limited at this date.

Q. Where would that experience be at the present time? Who would have it and what would it be based on? A. There might be a limited amount on the basis—you mean for projects of this magnitude?

Q. Let us start with projects of this magnitude. A. I don't know of any source of information on sodium systems.

Q. Let us take sodium systems smaller than the PRDC reactor. Is there any information available on such reactors? A. I think there is perhaps a limited amount on the EBRI. But I wouldn't think that would be comparable.

Q. Is it correct to say that there is no experience now available either to AEC or anybody else with respect to the cost of a waste disposal system for a sodium reactor using sodium as a coolant? A. By experience, you mean actual cost data on one that has been built?

Q. Yes. A. I don't think there is any cost data on a system for a plant of this size that is available;

Q. So in your opinion PRDC has no basis for that

[3294]

estimate of \$34,500? A. I think that was brought out by the testimony, wasn't it?

The Presiding Officer: I think on page 7 he testified it was too low.

Mr. Sigal: He testified?

The Presiding Officer: Yes, he testified it was too low.

Mr. Sigal: I am saying that PRDC has no basis for its estimate.

The Witness: I think Mr. Amorosi said in his testimony there was really no basis for the estimate.

By Mr. Sigal:

Q. In order that we may get some notion of the magni-

tude of the cost, can you give us some indication of what a waste disposal system for a reactor of this type costs?

A. For a water system, yes. On the PWR we are spending about \$3 million.

Q. \$3 million for the pressurized water reactor? A. That is a round figure.

Q. For the disposal system of the shippingport reactor?

A. That is my information.

Q. As far as you know, is there any reason to expect that the cost of a waste disposal system for the PRDC reactor would be any less?

[3295]

A. I think so.

Q. To what extent? A. I don't think the problem is perhaps as acute, although I am really not an authority on waste disposal systems.

Q. But so far as your available experience on the cost of waste disposal systems is concerned, you do have this information with respect to the pressurized water reactor?

A. Yes, I have that.

Q. And that shows \$3 million. A. Roughly.

Q. Is that system completed now? A. It is under construction.

Q. So that \$3 million even there is an estimate or is that a fixed figure? A. I think it is a fairly firm estimate.

Q. You say on page 8 that the company has allowed only \$17,200 for miscellaneous parts and in your opinion this should be 20 to 25 times higher. So can we say roughly in your opinion the figure would be around \$400,000? A. Three to four hundred thousand dollars, something like that.



Q. Then in the same paragraph you make reference to the \$100,000 allowance for plant equipment adjustments, which should be doubled, and you said this should be doubled or

[3296]

tripled. Can you make a choice there? Can we quadruple it for the sake of variety? A. I think the testimony ought to stand the way it is.

Q. You will put it between two and three hundred thousand dollars? A. Yes, something like that.

Q. Then the next paragraph on the same page, you say while it is difficult to point out line items in the estimate which appear to be out of line from your experience, you nevertheless point out some of them, which are estimated at too low a figure. Can you be a little more specific about the particular items you have mentioned? You say, for example, that \$30,000 for heating, lighting and ventilation is too low. What would be nearer to the probability as you see it? A. Ordinarily for buildings of this type, heating, lighting and ventilation will run 20 to 30 per cent. I think this particular building will have to have a fairly costly ventilation system.

Q. That is 20 to 30 per cent of what? A. Of \$423,000. That may be somewhat high, though.

Let me correct that and say 15 to 20 per cent.

Q. So that the cost at the minimum in your opinion would be around \$75,000? A. Yes, perhaps.

[3297]

Q. That would be about 15 per cent. So far as the figure for the element decay and storage building is con-

cerned, are you satisfied with that figure? You did not mention that as one of the items which you underestimated. But I wonder whether you considered that in connection with the other.

The Presiding Officer: What was that figure?

Mr. Sigal: The \$428,000 figure.

The Witness: I have no information on the size of that structure at all. There is a sketch in APDA 115 and this estimate, so it is a little difficult for me to say much about whether it is too small.

By Mr. Sigal:

Q. The next item mentioned is the cost per cubic yard for the concrete work around the reactor. Is that item included in another figure or didn't you just give any figure for that at all? A. That is given in Acker Exhibit 7.

Q. Yes, but I mean you don't state any figure for it. A. The figure is \$57 a cubic yard for the reinforcing steel and forms. My experience is that concrete around a reactor will cost considerably more than that. Several times that figure.

Q. Several times \$57? A. Yes, depending on conditions. I don't know too much

[3298]

about this job as to the details. I just have these sketches. But it could easily cost \$125 or \$150 a yard for this particular concrete.

Q. So what does it come to? A. I really don't know. I made up no amount for that.

Q. Does the exhibits give the number of cubic yards?

Mr. Claytor: Could I ask if we are talking about

item B-1 in Acker Exhibit 7, just to be sure which concrete it is?

The Witness: Yes, that is the concrete I am talking about.

The Presiding Officer: Is that the hot cave?

Mr. Claytor: Reactor foundation, vessel foundation and external concrete work.

The Witness: 2,130 cubic yards.

Mr. Claytor: I beg your pardon. That is item B-3.

The Witness: You are right.

Mr. Claytor: That is why I was confused as to whether it was item B-1 or B-3.

The Witness: It is the internal work around the reactor. That is B-3.

Mr. Claytor: Just to clarify this, if I may, Mr. Radley, this entire item is estimated at \$1,488,400.

Mr. Morrisson: Mr. Chairman, may I ask if the witness has this exhibit before him?

[3299]

The Presiding Officer: He may have it.

The Witness: Yes, it is Acker 7.

Mr. Sigal: I thought he had it.

Mr. Morrisson: I wanted to be sure.

By Mr. Sigal:

Q. Is that correct? A. That is correct, with contingencies.

Q. Yes. On the basis of your estimate what would that figure come to, or which item in that group of figures would you change? A. I would increase the allowance for concrete.

Q. From what to what? A. I really have not intended to increase. I merely point out this as one of the items in the estimate which appears to be low to me.

Q. In any event, as far as this particular item is concerned, you would say that the cost would be two to three times as high as they estimate? A. Just the concrete, which is really not a large part of this.

Q. Just the concrete? A. Yes.

Q. You don't make any comment on the rest of it? A. Not on the total amount.

The Presiding Officer: Isn't it a fact that they have

[3300]

under estimated everything here in Acker 7 with relation to these costs? I read your testimony and I was concerned a little bit because it looked as if they were under estimating everything.

The Witness: I don't mean to give that impression that everything was under estimated.

The Presiding Officer: A lot of things. There is a lot under estimated in that Acker exhibit, is that right?

The Witness: Yes, that is the burden of my testimony, I presume.

The Presiding Officer: That is the way I read it.

By Mr. Sigal:

Q. The next item you mentioned, Mr. Radley, is the hot cave for two cells of \$378,200. What would your estimate of that be? A. I really have no estimate for that hot cave, but I think that is low. Hot caves are very difficult to

estimate unless you have all the details. I think for the sort of work they will be doing they will spend more than that for the cave.

Q. Can you give some notion of where it might land? A million? A. Perhaps a half million.

The Presiding Officer: Under estimated?

The Witness: No, the total cost might be half a

[3301]

million dollars, let us say, roughly.

By Mr. Sigal:

Q. Then you go on to say that it is probable many costs have been overlooked since each line item in the estimate has to include certain work related thereto, and is not mentioned or described, and you point out electric wiring between buildings. Did you make any attempt to list the various items which may have been overlooked or under estimated? I mean a more complete list? You have given some examples. I wonder if you would try to be more exhaustive? A. I could give a few more examples. I think the core will turn out to be under estimated.

Q. What do you have to say about that? A. The amount given seems low for a project of this size by comparison with other cores.

Q. To what extent? A. I really have no idea as to what it will cost.

Q. Can you give us your experience with other cores?

A. Cores can cost as much as \$10 million.

Q. I am sorry. A. Cores can cost as much as \$10 million.

Q. What does this estimate show for PRDC? A. \$205,000.

Q. Are you in any position to give any more specific figure for the PRDC reactor on the basis of your

[3302]

experience? A. No. I can't go beyond saying that the amount given seems low to me.

Q. What other items have been under estimated? A. Item B-2 in Acker 7, containment vessel, shows an allowance for extras for air lock doors of \$30,000. I think that is quite low. Air locks are quite expensive; and I am sure that the \$30,000 is inadequate.

Q. What is your experience with air locks as to cost?

A. I would say for this project they may cost between one hundred and two hundred thousand dollars.

Q. Any other items? A. That is all.

Q. In your opinion as your testimony has indicated, there are probably many other items which have been either overlooked or under estimated? A. I think that is true.

Q. You state at the bottom of page 5 of your testimony that the nuclear portion of the project will cost several million dollars more than \$32,400,000 estimated by PRDC. If we add up simply the estimates you have made with their qualifications, on the specific items mentioned, it would appear that the under estimate is somewhere in the neighborhood of four to five million dollars. Would you say that is a fair statement, Mr. Radley?

[3303]

A. The testimony I have offered lists a number of items which support my opinion that the reactor is under estimated. But these various examples are not intended to add up to give an overrun.

Q. I know you did not intend them, but I am trying to draw some conclusions. Obviously this all relates to cost, and your figures must be used and examined with all flexibility that you have suggested they should possess. But nevertheless your testimony shows that with respect to site labor, the under estimate runs into millions. The same thing with reference to overhead expenses, and also the waste disposal system. We can go on with these various items. Certainly to say that the total has been under estimated by five million dollars is being very conservative, isn't it, Mr. Radley? A. I think I have gone about as far as I am prepared to go on the basis of the information I have when I use the words several millions.

Q. Several millions is anywhere from three to ten, isn't it? A. The dictionary says more than two, but not many.

Q. Are you familiar with the speech that Admiral Rickover gave recently on the matter of engineering problems and so forth, and the manufacturing problems with respect to reactors? The speech was discussed in Mr. Amorosi's testimony.

[3304]

A. I don't believe I am.

Q. On page 2, you point out that you have made estimates for many types of reactors and made or reviewed estimates of projects under construction. On the basis of your experience, can you tell us what differences have developed between the estimated cost for construction and the actual cost of construction of the various reactors which have been built by or under the AEC's direction? A. The PWR is an example which has gone from \$37,750,000 to \$55 million.



Q. That is not yet completed, is it? A. It is not finished yet.

Q. Does it appear that the cost will be around \$55 million? A. Yes, that is the present estimate.

Q. What other reactors can you mention? A. The engineering test reactor has gone from \$15 million to \$17 million, but that is not a power reactor. That is a research reactor. The Army package reactor is a fixed price project, so we don't have anything on that.

Q. It is the builder who rules it out on that and not AEC. What about the sodium reactor experiment? A. I have some rough figures on that for the construction portion. From an original figure of \$10 million it has gone to \$18,5 million.

[3305]

Q. That is still in the process of construction or is that completed? A. I believe it is substantially completed now. Of course, that is a research project. There is a considerable research.

Mr. Morrisson: I believe that reactor has gone critical.

The Witness: That is my understanding. It is substantially completed.

By Mr. Sigal:

Q. Can you mention any others? A. I might mention the boiling water reactor at Argonne which was built substantially for the estimate of \$4.5 million. It is now \$4.6 million. Those are some examples.

Mr. Sigal: That is all.

The Presiding Officer: Thank you, Mr. Sigal. Mr. Claytor, you may cross examine.

*Cross Examination by Mr. Claytor*

Q. Mr. Radley, first of all, with respect to the item of miscellaneous spare parts which we discussed a few moments ago, it would be possible, would it not, either to include a very substantial allowance as an initial capital cost for a large initial supply of miscellaneous parts, or it might be possible to include instead a large operating allowance for

[3306]

the purchase of miscellaneous spare parts in your operating budget, with a proportionately smaller initial supply, would it not? A. Yes, you can do your accounting that way.

Q. So that if it were done that way, obviously the amount of initial supply of spare parts to be included in your construction budget would be lower than they otherwise would. A. Yes. The accounting could be carried on that way.

The Presiding Officer: You amortize spare parts, don't you?

The Witness: We ordinarily would include a large supply of spare parts.

The Presiding Officer: But you would amortize them, wouldn't you, over a period of years?

The Witness: I don't know.

By Mr. Claytor:

Q. Now I would like to discuss for a moment the figure for engineering design and expenses of \$900,000, item P on Acker Exhibit 7. I think you said that it would be realistic to use an estimate for engineering services of

3306

at least \$1,800,000 for this. A. At least twice as high as the \$900,000, that is correct.

Q. That would be \$1,800,000.

[3307]

A. That is right.

Q. You took into consideration, didn't you, that the work called for by this item is to be performed under contract with Commonwealth Associates? A. Yes, I know of that.

Q. In connection with estimating the costs that would be incurred in performing this work, I would like to get some idea of what kinds of costs you assume would be incurred. What kinds of costs would be defrayed by this figure of \$900,000 or \$1,800,000, the estimated figure? A. You would like to have me tell you what engineering design—

Q. I would like to have you tell me what costs you assumed would have to be covered when you gave the opinion that it ought to be at least twice the figure that we estimated. A. That is what is commonly termed engineering design.

Q. Yes. But what costs are commonly covered by engineering design expenses? A. The cost of making initial working drawings. The cost of making the as-built drawings when the job is completed. The cost of expediting. The cost of inspection of the work which I understand is to be done by United Engineers for a fixed fee. I have taken that into account. Is it United Engineers?

Q. Are we not now mixing up the item for engineering

[3308]

services, erection supervision, which is United Engineers

and Constructors, and design and engineering item of \$900,000 which is Commonwealth Associates only? A. No. I am not mixing up anything. United Engineers is doing the inspection. Isn't that correct?

Q. That is right. A. I am not confusing construction superintendence with engineering at all.

Q. I just wanted to be sure. I am thinking about analyzing the costs that would be incurred by Commonwealth Associates in rendering these services. For example, I assume that you have assumed that the cost would then include Commonwealth Associates direct payroll costs of their employees engaged in this work—hourly rates times the number of hours with adjustments for payroll taxes, workmen's compensation and things of that sort. A. What is your question?

Q. My question is, have you assumed that one of the items of cost which would be included in this heading, engineering services, would be the direct payroll costs incurred by Commonwealth Associates for its employees engaged in this work? A. Commonwealth Associates are to do the engineering.

Q. At cost. In order to estimate whether or not the costs are correct, we must know what kind of costs are being defrayed by Commonwealth Associates.

[3309]

The Presiding Officer: Mr. Claytor, let him answer the question now. He is entitled to answer the question.

Mr. Claytor: He is indeed.

The Witness: You say they are going to do it at cost. What do you mean by cost?

Q. It has nothing to do with this figure of approximately \$3 million? A. No, they would not be charged in there.

Q. Could you tell what the figure of \$3 million which you say is not sufficient for indirect and overhead expenses, what type of work you have assumed is covered by that figure?

[3312]

A. Just what is given back here in item J. That is all defined. Shall I read it?

Q. If you mean the two paragraphs under J? A. Yes.

Q. You have assumed that this figure is to cover that work? A. Yes, that is what is stated here. I would point out there is an et cetera in the first paragraph which leaves me at a little bit of a loss.

Q. You take into consideration that a major portion of the work under J is to be performed by United Engineers and Constructors under a contract, or did you consider that is an entirely separate item? I just want to be sure we understand each other. A. United Engineers and Constructors are doing the inspection, which is a phase of the engineering. Is my memory correct that, for \$225,000, which hasn't anything to do with this item at all?

Q. I think the evidence—

The Presiding Officer: Does somebody know the answer to that question? Is the witness' statement correct, or do you know?

Mr. Morrisson: I don't recall.

Mr. Claytor: Mr. Acker's testimony in the record, I believe, you will find is to the effect that United

[3313]

Engineers and Constructors are to perform the

services covered under item J of Acker Exhibit 7 pursuant to a contract. That of this item of \$2,977,000 approximately \$225,000 is to be fee to United Engineers and Constructors pursuant to the contract.

The Presiding Officer: Let me ask you a question off the record.

(Discussion off the record.)

By Mr. Claytor:

Q. One other question on this item before you put that aside. A. I have not answered that question yet.

Q. We are leaving that aside until we can investigate.

The Presiding Officer: We will straighten it out in the morning that \$225,000 figure. I wish counsel would get together on that and agree what it represents.

By Mr. Claytor:

Q. One other question with respect to the figure which you described as indirect and overhead expenses in connection with the construction of the project. I would like to know if you have assumed that there is also included in this item the overhead expenses to PRDC of going forward with the construction of the project. That is to say, such expenses to PRDC of its office, its ordinary office personnel, its supervisory personnel at the office and the

[3314]

field and that type of expense. A. I have not considered this from the standpoint of what does what. You have a capital cost estimate here of \$32,400,000, and you have material and labor given in your estimate. It is customary for those items to mean direct charges.

three assistant managers, a secretarial force, one or two contracting officers and two or three people who assist in the expedition of the work. This is on their payroll. A. They correspond with the construction contractor's

[3317]

management staff.

Q. No. Their job would be solely to coordinate the various contractors, primarily it is an office management force. On such an assumption would not the expenses of maintaining such an office force normally fall within this item, an item of indirect and overhead expenses which would be part of the construction cost estimate? A. They might or might not, depending on how the job is handled. Sometimes owners carry on quite an activity in connection with their projects.

Q. If such expenses were included in your indirect and overhead expense item obviously the item would be larger than if all those expenses were not included in the item. A. Is that a question?

Q. That is a question. A. The more you put in the larger it gets.

Q. So that if an item of indirect and overhead expenses does not in fact include the cost of maintaining an office, a number of employees, secretarial service and such, obviously such an item would be smaller in the construction estimate than it would be if those expenses were in fact included, wouldn't it? A. This is an abstract question?

Q. Yes. A. Naturally. That doesn't necessarily apply to this.

[3318]

though.



The Presiding Officer: Mr. Claytor, I think it would be a good time to take a recess until in the morning.

Mr. Claytor: ~~I was~~ going to another item anyway, Mr. Examiner.

The Presiding Officer: Let the record show that we will be in recess until 10 o'clock tomorrow.

(Thereupon at 4:25 p. m., a recess was taken until Tuesday, June 18, 1957, at 10:00 a. m.)

[3320]

The Presiding Officer: The hearing will be in order.

Whereupon,

H. MONROE RADLEY resumed the stand as a witness, and, having been previously duly sworn, was examined and testified further as follows:

The Presiding Officer: You may proceed.

*Cross Examination (Resumed) by Mr. Claytor*

Q. I have just two or three more questions, Mr. Radley.

Could I direct your attention to Item B-3 of Acker Exhibit 7? When you said, Mr. Radley, that, in your opinion, the estimate for concrete work included in this item was low, did you mean that the material estimates per unit volume were low, the labor estimates were low, or that both were low? A. I think it is largely a labor matter here. It is largely labor.

Q. It is largely labor costs included there that were low? A. Yes.

Q. You think, then, that the material costs on that item are about right? A. Well, it is a little difficult. You see, you take this

[3321]

item concrete mix in place. That includes both material and labor. I presume \$18 will buy concrete out there. I think it is largely in the labor.

Q. So on that item it is the \$10 per unit per cubic yard labor cost that you particularly had in mind? A. Yes.

Q. Now, could I refer you to the next page, Item B-4, the sub-item heating, lighting and ventilation? Could you give me some idea of what proportion of that expense you have assumed is heating, what proportion is lighting, and what proportion is ventilation? A. I haven't made assumptions on that basis. I merely took it as a percentage of the total.

Q. As a percentage of the total? A. As a percentage of the total cost.

Q. So that on the basis of the analysis you have made, you couldn't break it down? A. I couldn't do that here. I probably could in my office. I believe I said yesterday that I thought probably the ventilation requirements were underestimated for this sort of a facility.

Mr. Claytor: Mr. Examiner; yesterday you asked me if I could obtain an approximate figure for the amount of engineering services and expenses to Commonwealth Associates that have been paid to date. I have an approximate figure as of

[3322]

the end of May. That is \$128,500, out of a total estimated amount of \$900,000.

The Presiding Officer: Thank you, Mr. Claytor.

Mr. Claytor: That is all I have, Mr. Examiner.

The Presiding Officer: Is there any re-direct of this witness?

Mr. Morrisson: I have one or two questions, Mr. Examiner.

*Re-direct Examination by Mr. Morrisson*

Q. Mr. Radley, do you have a copy of the transcript of the testimony which you gave yesterday? A. Yes.

Q. Will you look at page 3300, at the question of the Presiding Officer beginning at the bottom of 3299. Your answer says "I mean to give that impression that everything was underestimated." \$

I wonder if a negative was left out of that answer. A. I intended to say yesterday, and I think I did say, "I don't mean to give the impression that everything was underestimated." I think the word "don't" was omitted in error there, in the transcript.

Q. In other words, your position is that there are a number of specific items in Acker-7 which you regard as being underestimated, but not that everything in Acker 7

[3323]

is underestimated? A. That is correct.

Q. And that you also regard the over-all figure of \$32.4 million as underestimated? A. That is correct.

Q. On the following page, 3301, you refer to the core

By Mr. Clayton:

Q. We have a contract with Commonwealth Associates of which you are aware. A. Yes.

Q. The contract is not for a fixed fee but provides that the work will be performed at cost. Now, what I am trying to do is to find out what costs you assumed in saying the figure should be at least \$1,800,000. What costs you assumed would be defrayed by this figure of \$1,800,000. A. The cost of Commonwealth Associates, engineers, plus overhead, plus Commonwealth Associates' overhead costs.

Q. So you have assumed what we would be defraying here would be first—I am trying to do it in a little more detail—payroll costs of Commonwealth Associates.

A. I don't think we are getting anywhere in discussing Commonwealth Associates accounting procedures. I said engineering would run around \$1,800,000 at least.

Q. I am trying to test the basis on which you have reached the figure of \$1,800,000, since the figure

[3310]

necessarily, Mr. Radley, on the basis of the evidence already in the record depends upon the costs to Commonwealth Associates. In giving the opinion that the costs would be at least \$1,800,000, you must have assumed that certain expenditures by Commonwealth Associates would have to be covered by the \$1,800,000. I am trying to explore what expenditures by Commonwealth Associates you assumed would be covered. A. Engineering costs. Maybe I can answer it this way. Engineering costs consist basically of two things. One is the direct charges and the overhead charges.

The Presiding Officer: Let him answer the question.

Mr. Clayton: I thought he finished, Mr. Examiner.

The Witness: I finished.

By Mr. Clayton:

Q. So direct expenses of doing the work including payroll, including out of pocket expenditures for travel, and so forth. A. Travel, telephone, expediting.

Q. Plus a fair share for overhead allocable for the job. A. That is the usual practice.

Q. How about a reasonable fee or profit to the engineering firm? A. You just said profit is not included in here.

[3311]

Q. I am asking you. I think the evidence is silent about whether the profit is included or not. I am trying to find out whether, in giving your opinion that the figure should be \$1,800,000 you assumed that figure of \$1,800,000 would include in accordance with normal practice a reasonable fee or profit to Commonwealth Associates. A. I presume so, because when I said 15 percent included for engineering is a rough percentage, actually the profit on these engineering contracts is not of sufficient importance to make much difference one way or another.

Q. Now I would like to turn to another item, the item which you describe in your direct testimony on page 7 as indirect and overhead expenses in connection with the construction of this project. It is your assumption, is it not, that this is to include the construction engineering supervision by United Engineers and Constructors? A. I think we better look at the testimony on United Engineers. I think they are just doing inspection on this for \$225,000, which hasn't anything to do with this at all.

Q. That is right. A. To which there are certain indirect costs which are given here as \$2,977,000.

Q. That is right. A. That is a standard construction accounting procedure. Regardless of who does that, these costs are going too low.

Q. And in accordance with standard construction and accounting procedures, one of the indirect costs that would be included in a figure such as this would normally be the ordinary indirect overhead expenses of running whatever office has to be run, having your own employees supervise to the extent that they do supervise your actual construction, consultation with your contractors, and that type of thing is an item of indirect and overhead expense. That is the only question I have. A. What is your question?

Q. My question is this. In accordance with ordinary construction and accounting procedure, do you include in

[3315]

indirect and overhead expenses, the heading for indirect and overhead expenses, such items as the cost of running the office, the cost of having your own employees coordinate the work of the different contractors and what I would call general overhead.

The Presiding Officer: Mr. Claytor, it can't be both indirect labor and overhead. It has to be one or the other now.

Mr. Claytor: The way he describes this item in his testimony, Mr. Examiner, is indirect and overhead expenses. My inquiry is to find out if the type of expense which I have described is normally covered under that heading.

The Presiding Officer: It cannot be indirect labor

and overhead at the same time. It has to be one or the other.

Mr. Claytor: This is so. I am asking whether it is considered to be an indirect expense or an overhead expense, either or both.

The Presiding Officer: That is a fair question.

The Witness: The question in accounting terminology I would say this item includes both indirect and overhead costs.

By Mr. Claytor:

Q. By which you include the types of expenditures I have just mentioned.

[3316]

A. Right here on J the whole thing is spelled out.

Q. My difficulty, Mr. Radley, may partly be with the description in J. The description in J does not specifically mention such items as the cost of renting an office, for instance, the cost of maintaining supervisory personnel on the payroll, and I would assume that if there are such costs in connection with the construction of a project, regular construction and accounting procedure would call for those costs to be included in an item such as this. A. That is my understanding of J.

Q. Thank you. A. Let me correct that. I don't want to say that what you said is right. I want to say that item J describes their costs.

Q. Yes, I understand that item J describes our cost. I still feel we must clear up this. Perhaps I can get at it this way.

Let us assume that a reactor construction project from the beginning of construction has on its payroll a manager,



as being possibly underestimated. In the first place, you stated the core estimate as \$205,000. Is not the actual figure on Acker-7 somewhat higher than that, when one takes into account installation cost and contingencies? A. Yes. I was speaking from memory. The 205 is for the fuel elements only, I believe.

Q. Do you have the actual installation cost? It is 300-and-some thousand, isn't it? A. I think it is about 335,000, installed.

Q. You stated in the lower part of page 3301, that cores can cost as much as \$10 million. Did you mean in so stating to imply that you thought the core for this reactor might cost as much as \$10 million? A. No, I did not.

Q. Mr. Radley, you have stated in your testimony in rather general terms that you believe the construction cost had been underestimated by several million dollars. Are you prepared to give an estimate as to what you believe the construction of this project will cost?

[3324]

A. No, I am not.

Q. Can you indicate why you do not feel in a position to give a specific estimate on this construction cost? A. It is because of the lack of information on the project, the uncertainties that remain.

Q. In other words, you do not feel that the opportunity that you have had to review this project, the information that has been available to you, has placed you in a position in which you could give the kind of estimate that you would normally be expected to give on a commission project, is that right? A. That is true.

Q. Do you believe it is possible that this project could

be constructed for the estimated cost of \$32,400,000? A. I do not.

Q. Mr. Radley, as I understand the record, there is an excess available to the company of a little over \$2 million between what the company has stated as its cash requirements, and the funds available to them through commitments and loans.

Let me explain how I arrive at that figure.

Mr. Acker, at page 16 of his written testimony, states the cash requirements at \$36,216,000. This is arrived at by deducting from the total cost of \$43,216,000, an amount of \$7 million which is stated to be a contribution by APDA. That figure of \$36,216,000 is less by a little more

[3325]

than \$2 million than the total of commitments of \$23,540,000, and bank loans of \$15 million, to all of which Mr. Acker has testified.

So there is a difference here of somewhat more than \$2 million.

Do you believe it likely that the construction cost of the reactor will exceed the estimated cost by more than \$2 million? A. I do.

Mr. Morrisson: That is all I have.

The Presiding Officer: Is there anything further of this witness?

Mr. Sigal: Yes.

*Re-cross Examination by Mr. Sigal*

Q. You have stated that you do not have sufficient information to enable you to give a specific estimate on the total construction cost, is that right? A. Yes.

Q. Can you state what additional types of information you would need from PRDC in order to arrive at a specific estimate? A. I can give you sort of a general idea.

Q. That is all I am asking for, yes. A. The sketches in the APDA-115 are not adequate, for one thing, to show the size of the buildings. They are not

[3326]

described very completely. There are not very many dimensions anywhere. There are a great many uncertainties as to what is required in the project. There is a general lack of information throughout.

Q. When you say a general lack of information, you are now talking about the design of the building? A. Well, that is just an example.

Q. Yes. All right, are there any additional types of information that you could get from a report, say, on their accounting procedures? Would you want that? A. That would be helpful, too, yes.

Q. Do you think that there is enough information provided now to determine what the operating costs would be? A. I am not qualified on operating costs.

Q. Would you not want the same types of information with respect to overhead, indirect costs, and so forth, with respect to operating costs and accounting as you would for construction costs and accounting? A. I say, operating costs are out of my field.

Mr. Sigal: That is all.

The Presiding Officer: Is there anything further of this witness?

If not, you may be excused. Thank you, Mr. Radley.

Q. And you are assuming an increase in all your other costs, all your other prices, at 4.2 percent a year? A. Not necessarily 4.2 percent a year, Mr. Sigal. That is on the basis of the escalation formula provided for in the schedule for the price of plutonium.

Q. The escalation is based on the increase in the BLS cost of living figures? A. That is right.

Q. Can you estimate that there is going to be this increase in the price of plutonium over this ten-year period?

A. I certainly can estimate it, yes.

Q. I mean, what is the rational basis of your conclusion that the prices are going to go up at the rate of 4.2 percent a year? A. On the basis of the trend from 1955 to date. That is the best thing I know of.

Q. You think the prices will continue to go up yearly on that trend? A. I think it is a realistic assumption for this purpose.

Q. Nevertheless, you have not taken that trend into consideration with respect to any of your construction and

[3437]

operating cost, or prices other than plutonium, have you?

A. Yes. Not that exact 4.2 percent, no.

Q. What figure have you used? A. We have escalated coal cost as the basis for our steam revenue.

We have escalated, we have provision for escalation on labor and our construction estimate.

And I would have to refresh my mind as to the other elements of our either construction or operating costs which we have included escalation in.

Q. Do you have provision for escalation of your pro-

duction cost throughout the ten-year operating period?

A. Some elements of the cost, yes.

Q. What elements of the cost? A. I said I would have to refresh my mind on that, Mr. Sigal. I know that the steam price is escalated.

Q. In regard to your statement here in Acker Exhibit 26, you say that if the plutonium prices are escalated 4.2 percent a year, your income, assuming a basis of twelve dollars per gram, would be \$22,422,000 in a ten-year period.

A. That is right.

Q. Which would be \$10,328,000 less than you now estimate your income to be? A. That is right.

Q. Taking that ten-million dollar difference, have you

[3438]

made any provision for the contingency that your plutonium income would be ten million dollars less than you have now estimated? A. No, because it is a completely unknown quantity as to what the government price of plutonium will be after June 30, 1963.

Q. But it is a fair conclusion, is it not, Mr. Acker, that whether your reduced income is on the order of ten million dollars or eighteen million dollars, PRDC reactor could not operate on the basis of the reduced income? A. No, I will not say that.

Q. You would not say that? A. No.

Q. How could you operate it? A. We could operate it if the member companies felt that it was of sufficient importance to go forward with the project to put up the additional operating funds required.

Q. And, of course, there is not now an undertaking

ABEL WOLMAN

*Cross Examination by Claytor*

[3357]

Q. Dr. Wolman, in your opinion, does the question of whether or not this construction now goes forward at this site involve any question of public safety? A. It does not to my mind.

Q. It is a question of balancing the expenditures of P. R. D. C's money against the probability that the facility may or may not be permitted to be operated. Is that how you view it? A. That is correct.

Q. Now, Dr. Wolman, you have mentioned both in your narrative statement and this morning a number of items of additional information which you think should be supplied. In your opinion, is this the additional information that is needed in order to enable you to reach the kind of definitive conclusion about the environmental suitability of the site which you should make prior to operation of this reactor? A. That is correct.

Mr. Morrisson: I did not hear the witness' answer.

The Witness: "That is correct."

By Mr. Claytor

Q. On page 18 of your narrative testimony you say, there are "certain specific problems with respect to the proposed site which would have to be resolved before a determination could be made as to

[3358]

suitability of the site even for a reactor whose stability and basic safety had been established. This is what you meant when you made that statement in effect? A. That is correct.

Q. And is the same true with respect to the statement on page 20 of your narrative statement where you say that no definitive determination with respect to the suitability of the site can be made until certain additional information is supplied? A. That is true.

Q. Now, Dr. Wolman, if adequate information is developed in the categories which you have discussed in your direct testimony and also this morning, will there be, in your opinion, sufficient information to enable you to give a final and definitive evaluation of this site? A. I believe that is correct.

Q. Now, Dr. Wolman, on page 14 of your direct testimony, you say that in your opinion the proposed site would be satisfactory from the point of view of its accident potentiality for a reactor that is inherently safe and reliable if it could be shown that no credible accident can release fission products into the atmosphere. A. Yes.

Q. Again on page 19, you say at the bottom of the page that, based on information available and assuming adequate

[3359]

containment and facilities and procedure for the disposal of waste surrounding populations would probably not be endangered by normal operation. A. That is my claim.

Q. Now, Dr. Wolman, assuming that the reactor is ade-



quately shown to be safe, stable and reliable, and that no credible accident can breach the containment building, would it be fair to summarize your opinion as saying that, although there is not yet sufficient information to enable you to reach definitive conclusions, there is rather sufficient information to enable you to say that this site appears generally suitable from the standpoint of public safety for a reactor of this power? A. With your two assumptions, I would say that that is true with one reservation. I would still want to wait upon the results of the meteorological studies. If they turn out to be very unfavorable, I would then have a further reservation even as to the suitability of the site.

Q. Well, even if the meteorological studies should turn out to be very unfavorable, are there not provisions which could be made which might enable a reactor of this power to be operated on this site? A. I am sure that there are. They would have to again be taken into account. They would have to find their way into the design and construction so as to reduce by another

[3360]

magnitude the possibility or the probability of a release under unfavorable meteorological conditions.

Q. Then the addition of the meteorological condition really means that we must make another assumption before we say that on the information we now have that this site is generally suitable from the standpoint of public safety for a reactor of this power, and that an additional assumption is if the meteorological conditions turn out to be quite unfavorable we may have to make some additional changes in the actual containment or in other protective

measures to make more sure that we will not have release of fission products. A. That is correct. What I am doing is saying that I have substitution values for various things all on the basic assumption that the stability of the reactor is agreed. There are alternatives for added protection where added protection seems necessary at that site.

Q. Now, with the exception of the additional meteorological information which we have just been discussing, is it true that the additional information which you have indicated should be supplied is of such a nature that it is not likely, in your opinion, to indicate the existence of any new problems or conditions affecting environmental safety which cannot adequately be provided for or protected against? A. It is not likely but I would like my testimony to show that I or my equivalent would have the opportunity for

[3361]

for that ultimate appraisal.

Q. Of course, my question assumes that there would have to be a definitive determination of this question prior to operation. The question is designed to test only the question of probability. A. Well, on the probability, I would say that it is unlikely that there would be disabilities of environment that would work counter to such a decision.

Q. And even the meteorological disability, when we call it that, is one that can be met? A. I think that can be met if understood and if appraised.

ERNEST R. ACKER (recalled)

[3392]

*Cross Examination by Mr. Sigal*

By Mr. Sigal:

Q. Mr. Acker, let us assume that AEC does not have an appropriation to carry out its contract, the contract between AEC and PRDC. Will PRDC continue with the construction of the reactor? A. Mr. Sigal, we have been proceeding, of course, under the assumption that the commitment in the contract made by AEC would be supported by appropriation; that is, the commitment to spend \$4,450,000 for research and development work on this reactor.

The contract was entered into under the demonstration power reactor program which invited industry to participate with government in the development of nuclear power on a large scale.

We would be disappointed if Congress did not appropriate funds to permit the AEC to go through with its commitment in this contract. We might go out and raise the funds to take care of this research work ourselves.

Certainly this group has demonstrated in everything it has done so far that it has been willing and able to put the money on the barrelhead to meet contingencies as they arose and to demonstrate our good faith in going through with this project and I think that we could raise the funds to replace this appropriation if it is not made.

However--

[3398]

Q. Now you state on page 1 of your supplemental, Mr. Acker, that on June 19, 1957, the Executive Committee of PRDC has offered a resolution requesting its utility members to agree to make additional contributions during the year 1961. Do you have a copy of that resolution? A. I have a copy of the minutes of the meeting.

Q. Well, in whatever form you have it. I am interested in seeing a copy of the resolution that was adopted by PRDC. A. I have the minutes of that executive Committee meeting at which that resolution was adopted. Would you like to have me read the resolution?

Q. All right; go ahead. A. And the preamble as well.

Q. I don't know what is in it, Mr. Acker, so you proceed and we will ask questions if we are not satisfied. A. This is an excerpt from the minutes of the Executive

[3399]

Committee meeting of Power Reactor Development Company, held on June 19, 1957:

"A discussion was had of the comparative schedule of plant component cost estimates and commitments accompanying the Treasurer's report and a showing with respect to items there covered of an over-run of 7.4 per cent over estimates which include contingency allowance.

"In view of this over-run and in view of the generally rising trend of construction costs, it was decided that this committee can recommend to the trustees that the Company's financial resources be further increased by extending the present 5-year base contribution commitment of utility company members an additional sixth year.

"Accordingly on motion duly made, seconded and unani-

mously carried, it was resolved that the Executive Committee recommend to the trustees that the trustees request all utility company members to make an additional commitment to PRDC equal to 20 per cent of their prior commitment payable on 30 days demand during the year 1961 and to be evidenced by a supplementary commitment letter prepared in the terms of the attached form.

"This letter shall be supported by authorizing resolutions of each Board of Directors in substantial accordance with the form attached hereto."

Q. I understand, Mr. Acker, that there are two reasons

[3400]

for the request for additional contributions, namely, the information that there was already an over-run of 7.4 per cent in your costs and, secondly, that there is a rising trend of costs in general. A. That is right.

Q. Presumably construction costs, I suppose. A. That is right.

Q. Now, does the requested additional commitment in the amount of \$3,908,000 constitute the amount necessary to meet your anticipated over-run? A. We have no anticipated over-run definitely, Mr. Sigal, but this amount that we will realize as a result of this call, together with other free funds which we will have available, will give us, in the opinion of the Executive Committee and the staff, a sufficiently substantial margin of resources over actual construction costs, whatever they may ultimately be, to go forward on a perfectly confident basis that we can meet such cost.

I would like to give you the figures to substantiate what I have said. We will have when we have received the com-

mitments from the Southern Company members a total of \$3,908,000 of excess resources. We will have, on the basis of our financial schedules, as submitted in amendment to the application, at the end of the construction period free cash aside from working capital, of \$1,520,000.

[3401]

In addition—

Q. I am sorry, I did not understand.

How did you identify that figure? A. I am reading from my notes but they can be substantiated by the financial schedules if you want to look at them now.

Q. I wanted to know how you identify that figure of \$1.5 million. A. In the construction period financial schedule there is a figure showing the cash balance at the end of the construction period.

Mr. Morrisson: Are you referring to Exhibit XLIII.

The Witness: Exhibit XLIII, Schedule 1.

Mr. Claytor: It is Exhibit XLIII.

The Witness: I beg your pardon, Exhibit XLIII. Schedule 1 shows a cash balance at the end of construction period of \$2,695,000. That includes of course \$1,175,000 of working capital, which we consider is not available for excess construction cost because we are going to carry that all through the operating period.

The difference left from the working capital is \$1,520,000.

Mr. Morrisson: Can I clarify something here?

You said you were referring to Exhibit XLIII. Are we to take it Exhibit XLIII is based on a revised construction

[3402]

schedule now supersedes Exhibit XXVIII, based on the original construction schedule?

Mr. Claytor: I am sorry.

Mr. Morrisson: I am confused as to which exhibit you are referring. XXVIII is based on the original construction schedule and XLIII on the revised.

Mr. Claytor: I don't think one can say that it supersedes it. I think they are made on two different assumptions. Exhibit XXVIII on what the testimony showed, is the existing construction schedule. Exhibit XLIII is on the tentative revised construction schedule which has not been formally adopted and we have computed the attached flow computation on both assumptions to show what the picture would be. The actual schedule might conceivably be something between them.

Mr. Morrisson: In any event, Mr. Acker is referring to Exhibit XLIII?

Mr. Claytor: Referring to Exhibit XLIII in giving that figure.

The Witness: Then in addition, the cost of the APDA facilities which will ultimately be turned over to the PRDC and incorporated in the reactor plant are included in the PRDC cost estimate at \$4,131,700.

By Mr. Sigal

Q. Mr. Acker, if I may, we will get to the construction

[3403]

estimates later. A. This is developing a figure in response to your question, Mr. Sigal.



Q. All right, proceed. A. Now, PRDC has taken the value of these facilities into its structure on the receipt side at only \$3 million, to put it on a conservative basis.

Q. That is not new? A. No, but I would like to say that the difference of \$1,130,000 is an element of our cost estimate which we will not be required to meet. The difference between the cost at which it is included and the \$3 million value which we will put on it, so that represents in addition a margin available for overrun of the construction estimate.

Now if you will add the \$3,908,000, the \$1,520,000 and the \$1,131,700, you get a figure of available, unallocated resources of \$6,559,700, which we consider, with the contingencies already provided for in our construction estimate an ample margin to take care of whatever overrun there may be on the actual versus the estimated cost.

Q. Now, this is including of course the \$3,900,000 that you expect to get in 1961? A. That is right.

\* \* \*

[3408]

Q. Well, you point out on page 2 of your supplemental testimony the additional contribution requested and you name the companies that have already made commitments. Do any of those commitments require approval by public utility commissions of the respective states? A. We are advised that they do not.

Q. None of them? A. That is right.

Q. Including Detroit Edison? A. That is right.

Q. Are you basing this on your own opinion or legal opinion? A. Legal opinion obtained from counsel.

\* \* \*

[3432]

Q. Now, going to page 6 of your testimony, you state at the bottom of page 6 that in your computation regarding the income from the sales of plutonium, that you have based it for the period after June 30, 1962, on a price of thirty dollars per gram of plutonium sold to AEC.

Have you given consideration to the income you would derive if the price of plutonium were lower than thirty dollars per gram after that period? A. Yes, we have.

[3433]

Q. What have you done in that respect? A. We have calculated what our total plutonium revenue would be during the proposed ten-year operating period on the basis of twelve dollars for plutonium as the base price as of the middle of 1955, escalated in accordance with the provisions of the schedule to date and assuming the same annual escalation applicable in the future years.

Mr. Morrisson: Excuse me. The witness said as of the middle of 1955; is that correct?

The Witness: Yes.

Mr. Morrisson: Using the twelve dollar price in the middle of 1955?

The Witness: That is right.

Mr. Claytor: Escalated in accordance with Intervenor's Exhibit V.

By Mr. Sigal:

Q. Do you have the document, Mr. Acker? A. Yes.

Q. What do you have? You have a document making these calculations. May we see copies of it?

Mr. Claytor: Off the record.

The Presiding Officer: Off the record.  
(Discussion off the record.)

By Mr. Sigal:

Q. Now, the paper you have referred to contains a

[3434]

figure showing plutonium revenues based on a plutonium price of twelve dollars per gram after June 30, 1962, on unescalated and escalated bases?

Mr. Morrisson: If there is going to be a discussion of this paper, I wonder if it would not help to have it marked for identification.

Mr. Sigal: Do you want this introduced as yours?

Mr. Claytor: I would suggest if we are going to have examination on this that we mark a paper consisting of a single sheet entitled "Plutonium Revenues based on Plutonium Price of Twelve Dollars per Gram after June 30, 1962, on unescalated and escalated bases."

I suggest we mark it for identification as Acker Exhibit No. 26.

The Presiding Officer: The document just described will be marked for identification as Acker Exhibit No. 26.

(Acker Exhibit No. 26 was marked for identification.)

By Mr. Sigal:

Q. Mr. Acker, I call your attention to the first column of this exhibit. This shows that at twelve dollars per gram your total receipts during the operating period 1962 to 1971 will be \$14,139,000. A. That is right.

Q. And it also shows that this would be \$18,611,000

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less than your present estimated revenue, assuming thirty dollars per gram unescalated price after June 30, 1963. A. That is right.

Q. What provision, if any, has PRDC made for the contingency that the price after June 30, 1963 will be twelve dollars per gram? A. We have made no provision as yet, Mr. Sigal. I think, however, we should say that that would be an extreme assumption because on the basis of the present schedule there is escalation provided so that it would be more realistic to use the second column showing a reduction of plutonium revenue of \$10,328,000 as a measure of what additional provision we might have to make.

Q. Well, whether or not it is more reasonable or realistic to do so is not something that you are in any position to say at this time, are you, Mr. Acker? A. I think I am on the basis of my own judgment.

Q. That there is going to be this increase in price over the period of time involved? A. I think that is a fair assumption, yes.

Q. What is your assumption with regard to the increase in prices? A. 4.2 percent per year.

Q. Per year? A. Escalation applicable under the schedule.

[3436]

Q. Have you made any such calculation with respect to any other prices with which you deal? A. Yes.

by any of these contributing companies to make up any such difference? A. Certainly not. It would be foolish for anyone to undertake to do so until they know what the facts which they might have to deal with might be.

It may be entirely possible that this reactor might be modified to burn plutonium as a fuel, which would change the

[3439]

economics entirely.

Q. At the present time, your experts do not anticipate that during this ten-year operating period plutonium will be used as a fuel? A. No, I will not say that they do not.

Q. Pardon? A. I will not say that they do not anticipate it might be used for fuel.

Q. Would you say that they do anticipate it will be used for fuel? A. No, I will not say that, either.

But I say that is a matter that will have to be dealt with at the time.

Q. On page 8 of your supplemental testimony, you say that in projecting your operations over the ten-year period PRDC has assumed that the amortization payments will be met by the guarantor companies. A. That is right.

Q. It is clear, of course, that PRDC itself will not be able to repay its fifteen million dollar loan from its own income derived from operation? A. That is right.

Q. Now, you say you assume that the contributing companies will pay their guarantee. I gather from your written statement that the guarantor companies will meet these payments

[3440]

in a way that your loan agreement would have called for.

A. We have the guarantee, Mr. Sigal.

Q. You have the guarantee from the contributors to the bank? A. That is right.

If PRDC cannot meet the payments, the member companies will guarantee the loans and are firmly committed to do it.

Q. But they are not going to do it by way of paying the money directly to the bank? A. I don't know at this moment.

Q. You don't know? A. I would think that as a practical matter they would put PRDC in funds to make payments to the bank.

Q. Is it your assumption, then, that PRDC will receive from each of these guarantors as part of this income enough money each quarter to pay the amount that falls due on your loan agreement? A. Absolutely.

Q. You are assuming that simply as a matter of good business? A. Mr. Sigal, if they did not do it, PRDC would be thrown into default and the whole principle of the loan is accelerated, the maturity of the loan is accelerated at the time of default, and these companies would have to make the full payment in any event under the guarantee.

[3441]

Q. What assurance is there, Mr. Acker, that these companies are not going to be willing to let all these payments be accelerated and pay off their loans to the banks?

A. What is my assurance?

Q. Yes. A. It does not make any difference to me

whether they do, or not. If they want to pay it all off at once, so much the better. Then PRDC is free and clear of the loan.

But if it can be done on the basis of their spreading the payments out as provided for under the loan agreement, it seems to me it is perfectly all right for them to do that. The loan gets repaid under any circumstances.

Q. So far as you are concerned, it makes no difference how they do it, or whether there is default on the loans, or not, you consider that that is not a concern of PRDC?

A. I think I have a firm commitment and we have made this statement merely to explain the basis on which this financial schedule was prepared.

Q. Now, on the same page, Mr. Acker, you say that your anticipated production costs have not changed since those calculated in Acker Exhibit No. 10; is that right?

A. That is right.

Q. Now, are you saying, then, that despite the judgment of the trustees of PRDC and in spite of your anticipation that costs are going to rise on a steady trend, you,

[3442]

nevertheless, estimate your production cost without any change. Why is that? A. Without any change from the previous Exhibit C?

Q. Yes. A. I said before, Mr. Sigal, I would have to refresh my memory as to the extent at which escalation was provided in Exhibit 10 for various elements of production cost.

If it was provided, then it seems to me it would not be necessary to change the anticipated production cost in the new exhibit.



Q. Of course, you are not prepared to say that that is the case? A. I am not prepared to at the moment. I said I would have to refresh my memory on it by examining the financial schedules.

Q. Do you know whether or not there has been any reexamination of the production cost during the operating period since you last testified in this case? A. There has not been, to my knowledge.

Mr. Sigal: Just one moment, please.

Mr. Claytor: We were handing the witness Acker Exhibit 10 to which you were referring, Mr. Sigal.

The Witness: I can answer your former question, if you wish to have it answered now, Mr. Sigal, as to what provision is made in the escalation of the production cost.

[3443]

By Mr. Sigal:

Q. All right, you may answer. A. I am quoting from Exhibit 10, under production cost, under operation, labor, the labor costs are escalated at four percent compounded annually.

The material costs, we provide no escalation.

As to maintenance, under labor, again the labor costs are escalated four percent compounded annually.

As to material and maintenance, there is no escalation provided. There is no escalation provided as to general administrative overhead, as to auxiliary services.

There would be escalation to the extent that the contracts for these services provided.

As to auxiliary power, there is no provision for escalation.

Q. So far as Exhibit X shows, the only escalation provided is that with respect to labor costs? A. So far as the cost estimates in Exhibit X are concerned, that is right.

Q. I am talking about production cost. A. Yes.

Q. So the material costs are general administrative overhead, auxiliary services, and so on. None of those provide for escalation? A. That is right.

[3444]

Q. And the same is true for the processing costs? You provide for no escalation in your processing costs? A. That is right.

Q. So that overall, the escalation provided, as far as your operating cost is concerned, is a minor fraction of the total, is it not? A. It depends on what you mean by minor fraction. I have not calculated it. I don't know.

Q. In any event, it is clear from Acker Exhibit 10 what items provide escalation and what do not.

Now, under the circumstances, Mr. Acker, since you have refreshed your recollection with respect to the production cost and with respect to the matter of escalation, in your opinion, does the estimate of operating costs that do not cover escalation, or substantial ranges of those costs, constitute a reasonable basis for estimating your costs for that period? A. I believe so.

Q. So that by the same terms, it would be just as reasonable not to consider escalation of plutonium prices?

A. I don't think that, Mr. Sigal. It depends on the basis of your original estimate. If you are making labor cost estimates, it is customary to escalate them.

You have some basis of determining what a reasonable, fair percentage escalation might be.

But if you make your original estimate of the cost of

[3445]

materials annually liberal to begin with, there is no reason for escalating it.

When you come to the question of plutonium revenue, where your revenue is a very material part of your total financial structure, I think it is entirely reasonable to escalate them.

By the same token, I feel it is entirely reasonable to escalate your steam reserve.

Q. So you feel that the matter of escalation or items for escalation should be included only in those situations where you have made a pretty tight estimate of cost initially? A. Made too tight. I don't think that characterizes what I have said properly, Mr. Sigal.

What I am saying is that you have two choices when you are going to estimate further cost. As to labor, you start with the present-day labor rates and escalate them. That does not mean you made too tight an estimate of your original cost. You have taken from what you know to begin with and escalated it.

Now, against that, the other type of estimating is to make a liberal provision for an item and carry it through your future period and based on your judgment that that will amply provide for it.

It is a question of an exact formula against a judgment figure.

[3446]

Q. So you can provide an exact formula only with re-

spect to labor and you cannot provide an exact formula with respect to material and other costs? A. I think it is less reasonable to provide an exact escalation basis for the whole heterogenous mass of different material.

Q. So that you feel that you can now, for example, provide an exact labor cost in 1962? A. Mr. Sigal, I have never said that.

Q. You provide for escalation in 1962 based on labor cost? A. I have never said that was an exact estimate. I have said that that was the basis for our estimate which we think is a reasonable basis, but I have not stated it resulted in an exact labor cost in 1962.

Q. I am only trying to get an explanation from you as to why with respect to certain costs you provided escalation and with respect to other costs you do not provide for escalation.

My understanding was that where you were able to provide a more or less precise estimate of current costs, you also provided for escalation. And where you are not able to provide a more or less precise estimate, you were liberal and, therefore, did not need an escalation factor; is that right? A. Yes.

[3447]

Q. So I, therefore, ask you, Mr. Acker, can you now, inasmuch as you have provided for an escalation factor on labor beginning in 1962, say that the labor figure for 1962 is more or less precise? A. It is as precise as a result of the application of an escalation percentage, Mr. Sigal; it is only as good as your judgment is as to what that escalation figure should be for the period.

That is the nature of an estimate.

Q. Now, Mr. Acker, on page 10 of your supplemental testimony, you state on the basis of the statement received from Commonwealth Associates, that a stretchout of construction schedule of six to eight months is likely.

Now, can you tell us what has made that eight-month stretchout necessary? A. Delay in the fabrication of some of the important elements ultimately going into the reactor structure.

Q. Do you know what elements have been delayed? A. Particularly the reactor vessel.

Q. Is that in itself the delay factor which delayed you for eight months? A. I would say that is the largest single factor, yes.

Q. Now, that reactor vessel is to be installed in 1958, is it not? A. That is right.

[3448]

Q. When was it supposed to have been installed? A. Under the present schedule, prior to this examination referred to which Commonwealth Associates have made, the reactor vessel was due for delivery in January of 1958.

Q. When is it due now? A. Now wait, let me go back, Mr. Sigal. It was due for delivery this year on the basis of the present schedule.

On the basis of the stretched out schedule, it is due for delivery in the early part of 1958. That is the particular reason for the stretchout.

Q. Now, I call your attention to Exhibit XLIII, a letter from Commonwealth Associates. A. Yes.

Q. You will note there in the second paragraph that they

say the reactor vessel is going to be delivered to the job by January 15, 1958. A. That is right.

Q. Now, that is certainly not six or eight months after the time it was previously scheduled for delivery, is it?

A. Yes.

Q. When was it supposed to be delivered before? A. I think in August of this year.

Q. No matter how you figure it, Mr. Acker, that is obviously not eight months. A. We talked about a stretch-out of six to eight months.

[3449]

For the purpose of this exhibit, we have used the eight-month figure.

Q. Is there any other delay? A. I think that is the principal one, Mr. Sigal.

Q. Now, you will note that Commonwealth Associates are not at all certain that there will not be other delays or even a stretchout of more than eight months? A. I don't think anybody could be, Mr. Sigal.

Q. They say in this letter, Mr. Acker, that they have not completed their revised construction schedule in detail?

A. That is right.

Q. So that there may well be additional delays? A. Well, I think they conservatively gave us the figure of six to eight months and that they believe that when they have made definitive new schedules on an item to item basis, that it will fall within the eight-month period.

Q. Do you know why the reactor was delayed for six months or whatever it was? A. I suppose for the same reason that any other reactor vessel has been delayed from time to time as against a construction schedule. This is

an evolution process of fabricating these completely new components.

There are changes in design that occurred during the construction and fabricating period. There is a tremendous

[3450]

amount of research, metallurgy that has to be resolved, and there are many factors that are so completely different from anything that the manufacturers have ever been up against before that I would bet my bottom dollar that you will not find a reactor vessel that has been delivered on the original promised date.

Q. When was the contract for the reactor vessel let, Mr. Acker? A. I don't remember the date, Mr. Sigal. But my recollection is that we had fully expected the reactor vessel first to be delivered last October.

Mr. Claytor: Mr. Sigal, I believe from our records it is indicated that the order was first placed in the fall of 1955.

Mr. Morrisson: That is at page 2526 of the transcript. I looked it up this morning.

By Mr. Sigal:

Q. Was it actually let in 1955, Mr. Acker? A. I believe so, Mr. Sigal.

Q. At the time you testified in this case, was it not referred to as a proposal?

[3451]

A. I would not without refreshing my mind as to my testimony, I would not recall what terminology I used.



I would not want to say without refreshing my mind on my written testimony or written transcript as to how I did characterize this. But it is a fact that we had a proposal against which an order had been placed.

Q. I simply call your attention to Acker Exhibit 7, item C, reactor plant equipment, in which the reactor vessel is referred to as a proposal to APDA. A. Yes.

Q. This was in March 1957.

Mr. Clayton: And Acker Exhibit 20 states this as one of the items on order by APDA.

By Mr. Sigal:

Q. So that apparently was put on order some time around March of 1957? A. I think it was put on order long before that, Mr. Sigal.

Q. In any event, Mr. Acker, it does appear again from your own testimony that the difficulties involved in the manufacture of this item have necessitated an increase in the anticipated period of manufacture of something in the neighborhood of 50 per cent. A. Yes.

Q. Or more perhaps?

[3452]

A. Maybe.

Q. Do you have any assurance that other complicated items involved in this reactor will not be delayed 50 per cent or longer in the time required for manufacture? A. I don't have any assurance any more than you have anything else in life, Mr. Sigal. That is a possibility. We do not foresee any such similar delay would affect any other element.

Q. As a matter of fact, in March of 1957 when you tes-

tified, you saw no reason for a delay in the manufacture of this vessel by six or eight months, did you? A. That is right.

Q. But you say now no other item is likely to be delayed so far as its manufacture? A. I say now I know of no other item as to which we could expect that kind of delay.

Q. Why will the delay in the manufacture and installation of the reactor vessel cause an 8-month delay in the entire project in as much as many other items are on manufacture simultaneously with the reactor vessel? A. It would be because it is such an important component of the whole structure that to the extent that it is delayed the completion of the whole plant is delayed similarly.

Q. But the manufacture of the plant itself,

[3453]

Mr. Acker, is to be completed long before 1961. When you talk about the plant structure aside from the reactor?

A. Well, I am not saying that there are many other elements of the plant will not have been completed before that time. Let me give you an example of what I am talking about. If we are building a steam station and the delivery of the turbine is delayed for eight months, why, the completion of the plant is delayed for eight months. This is in the nature of that kind of equipment.

Q. Is it in the same nature, Mr. Acker? The entire plant aside from the reactor components themselves is to be completed in 1958, is it not? A. Under this stretch-out it is indicated the plant may not be completed until September 1, 1960.

Q. That is just my point, Mr. Acker. Why will a delay in the manufacture of the reactor vessel delay the entire project in as much as most of these other items proceed simultaneously as far as their manufacture is concerned?

Mr. Claytor: Mr. Examiner, he has answered the question twice.

Mr. Sigal: He has given a conclusion, Mr. Examiner. He has not explained why the delay is caused.

The Witness: I have given you my best explanation

[3454]

as to the reason for the delay of the reactor vessel. I say the plant can not be completed until the reactor vessel is installed and if there is an 8-month delay in the delivery of it as against the original final completion date for the whole plant, I think it is entirely reasonable to assume that there will be the same delay in the completion of the whole plant.

By Mr. Sigal:

Q. Is it reasonable to assume that? Why could not all the components be ready for installation when the reactor vessel itself was installed? A. Mr. Sigal, we will use our very best efforts to get this plant in operation just as rapidly as we can, I can assure you that.

Q. I welcome your assurance, Mr. Acker. What we want here is facts. I want to know whether or not you know why the delay of the installation of the reactor vessel to January 15, 1958, requires a delay until August 1961 in the completion of the reactor.

Mr. Claytor: Mr. Examiner, he has already explained how it works. It is exactly like a steam turbine in another plant. I feel that the explanation in answer to that question is already on the record and it is adequate. I think asking it over and over again comes under the heading of harassing the witness.

[3455]

Mr. Sigal: We are not talking of steam turbines. That is the first I have heard that there is any relation between steam turbines and reactor plants.

The Presiding Officer: Well, the witness was drawing the analogy in comparison with a steam turbine. I understood what he was driving at in answer to your question. I think you are asking the question over again.

Mr. Sigal: But he has not given any answer.

The Presiding Officer: He has given you what is his best judgment as to the reasons for the delay.

Mr. Sigal: The point I am trying to arrive at, Mr. Examiner, is whether or not Mr. Acker is qualified to have a judgment on the matter.

Now Mr. Acker is not a builder. Mr. Acker has never witnessed the building of a reactor plant.

The facts here show that the reactor vessel will be installed, they expect, around January 15, 1958. Their evidence here indicates that they will complete construction of the entire plant by August 31, 1961.

I am asking why the delay of the several months in the manufacture of the vessel requires a stretch-

out of the entire project, so late after the installation of the reactor vessel. Mr. Acker simply says that is how it is. If that is an answer, if that is the best that Mr. Acker can do, then perhaps we will have to have somebody who is qualified to

[3456]

answer the question. But certainly Mr. Acker has not answered the question.

The Presiding Officer: Mr. Sigal, I think you have made your point and I think Mr. Acker has given his answer and as to what his judgment is or is not I am afraid will be up to the Commission to determine and not the examiner.

Mr. Sigal: The point I am making, Mr. Examiner, is the point I started out with this morning. We are not given the opportunity of cross examination here because Mr. Acker does not know and we have not had a word that anybody else will be put on the stand who does know. The man who wrote this letter, Commonwealth Associates, all those responsible for the actual building of this reactor, have never shown up in this hearing. We have never been able to examine anybody who is actually responsible for the building of this reactor.

The Presiding Officer: Mr. Sigal, whatever weight is to be given to the testimony of Mr. Acker is for the determination of the Commission. I do not think we ought to pursue the point any further.

By Mr. Sigal:

Q. Mr. Acker at the bottom of the page of Exhibit XLII this sentence appears, the last sentence on the page:

"In addition we assume that overhead and administrative costs which we have never included in our construction

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estimate and which we understand has been estimated by your staff at \$1,816,000 to December 31, 1960 would also have to be increased to cover the additional time allocated to construction and testing."

Can you explain that sentence, please? A. If you have a longer construction period, what they are saying is that you will have a longer period of administrative expense. And responsive to that factor in estimating the new cost, over-all cost, we now estimate that for the original period plus the stretch-out period the administrative expense would increase to \$2,170,000.

Q. I am sorry, you lost me. \$2 million what? A. I am saying instead of \$1,816,000 of administrative expense during the construction and test period for the longer construction period, the administrative expense would be \$2,170,000.

Q. Now, are you including the increase in the cost of your financing as part of your administrative expense?

A. No.

Q. Where did you get this figure of \$2 million plus?

Mr. Claytor: Mr. Sigal; it is on schedule No. 2 of Exhibit XLIII.

By Mr. Sigal:

Q. Which figure are you referring to, Mr. Acker? A. The figure on schedule 2 of Exhibit XLIII. I am

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referring to the item, next to the last item on the page,

"administrative expense" totalling for the new stretched-out construction period \$2,170,000.

Q. Is that a correction of this figure of \$1,816,000? A. Is that a what?

Q. Correction.

I want to know where this figure of \$1,816,000 came from. Has it ever appeared before? A. Certainly. It has been evidenced in this proceeding right from the start.

Q. I ask you where does it appear.

Mr. Claytor: Exhibit XXVIII. It also appears in Mr. Acker's original narrative testimony at page 15.

By Mr. Sigal:

Q. This figure of \$1,816,000 is referred to by Mr. Moulton as a figure which has never been included in your construction estimate.

Now, is Mr. Moulton wrong? A. No, Mr. Moulton made merely the construction estimate but he did not in his figures include the administrative expense during the construction period. We added those as a result of our own estimate. He is merely saying that he has not been responsible for estimating that element of the construction cost in the past.

Q. What I have tried to inquire into, Mr. Acker, is the

[3459]

meaning of this sentence in this letter.

Now, if this has always been included as a part of your estimated expense and cost, whether you did the construction or otherwise, Mr. Moulton apparently found it necessary to make a specific reference to the fact that it has not been included in the construction estimate.



I am asking why he did that. A. I simply think he did it to clarify what his estimates covered, the estimated plant cost. To do that he is calling attention that he hasn't in the past included this administrative expense item but that we should take this into account and make such change as is necessary to reflect the higher cost in the longer construction period.

Q. Now, you will notice the very last phrase in that sentence that the additional time is allocated to construction and testing. A. Yes.

Q. It appears that Mr. Moulton did not consider the stretch-out to be caused entirely by additional construction time required. Isn't that what appears from this statement? A. Not to me, Mr. Sigal.

Q. Does not Mr. Moulton say that additional time is allocated to construction and testing? A. Yes, so far as the administrative expense is concerned.

[3460]

Q. I am not now talking about administrative expense. Mr. Moulton says that this figure would have to be increased to cover the additional time allocated to construction and testing. A. Yes, but I think he is talking about time allocated to construction and testing related to the administrative and overhead cost. You have to read the whole sentence, Mr. Sigal, to get the sense of it.

Q. But Mr. Moulton is saying that additional time is required for construction and testing, is he not? A. I don't think that is what he is saying at all. It seems to me if you read the whole sentence it is amply clear. He is talking about the overhead and administrative costs which

must be increased because of the additional time allocated to construction and testing.

Q. That is what I said, the additional time being allocated to construction and testing. So that the additional allocation of time is not merely for the purpose of construction but it also includes more time for testing. A. No, that is not the fact and our schedule I think makes that entirely clear. We have provided the same one year for a pre-operational test that we have provided in the past.

Q. As of what time do you expect the reactor to be completed under the new schedule?

[3461]

A. September 1, 1961.

Q. Is that within the time for which you now have a permit?

Mr. Claytor: I think the witness misunderstood your question or the witness and the question are not in agreement on what is meant by completion.

Do you mean the completion of the construction alone or do you mean the completion of construction and test period?

Mr. Sigal: I mean the completion of the reactor.

By Mr. Sigal:

Q. Will you look at Exhibit XLIII, Schedule No. 1, Mr. Acker. You will note the next to the last column of that exhibit. Do you have it before you? A. Which one?

Q. Exhibit XLIII, Schedule No. 1. A. Exhibit XLIII, yes.

Q. Now this schedule is titled "Preliminary Revised Construction Schedule." That shows that this revised con-

struction schedule provides for the end of construction on August 31, 1961, does it not? A. No. I am sorry if I misled you on that, but if you will look at the text which is the first page of that exhibit, you will see that statement is made that this schedule shows the source and application of cash during

[3462]

the construction period.

Further, this construction period includes the year 1956 and extends through the pre-operational testing ending August 31, 1961."

In other words, this is the date, August 31, 1961 is the beginning of the 10-year operating period. So that the construction of the plant, aside from the pre-operational testing, would have been September 1, 1960.

Q. That is what is stated, of course, in the letter of Commonwealth Associates in Exhibit XLIII. A. Yes. I thought you were asking me that question.

Q. Yes, but this exhibit itself states a revised construction schedule showing the construction period as ending August 31, 1961. A. Not if you read the text as well, Mr. Sigal.

Q. When does the pre-operational testing period begin? A. September 1, 1960.

Q. Does that appear here? A. It does if you will read that first paragraph of the text, stating the assumptions under which the exhibit was prepared.

Q. The first paragraph of the text, you say, of Exhibit XLIII? A. That is right.

Q. That shows that the pre-operational testing will

[3463]

begin on September 1, 1960. A. It states that it will end August 31, 1961, one year.

Q: It says "This construction period includes the year 1956 and extends through the pre-operational testing ending August 31, 1961."

Now that does not say that pre-operational testing begins on September 1, 1960? A. Mr. Sigal, I assume you remember that all through this testimony, certainly all through my testimony we have always talked about one year of pre-operational testing.

Q. I know what you are talking about, Mr. Acker. I am trying to find out what these documents mean that have been introduced in evidence. You talked about a good many things in March 1957 which have been changed since March 1957.

Now, I do not see in this material that has been introduced today that in anything except possibly the letter in Exhibit XLII that your pre-operational testing will begin September 1, 1960.

Mr. Claytor: I thought that was Mr. Acker's testimony about three times and it certainly is now in the record. If there is any doubt about it it has been dispelled in the last ten minutes.

The Presiding Officer: I thought the witness

[3464]

explained that, Mr. Sigal.

Shall we be in recess for about five minutes?  
(Brief recess.)

The Presiding Officer: The hearing will be in order.

By Mr. Sigal:

Q. Mr. Acker, you say on page 10 of your supplemental testimony that PRDC is not yet able to adopt a new definitive construction schedule. The question of schedule revision is still under study by Commonwealth Associates.

What is the reason for this delay in arriving at the definitive construction schedule? A. Because of the study which Commonwealth Associates is currently making of each individual item of the construction schedule. That has not been concluded as yet.

Q. Construction of the reactor started a year ago? A. Yes.

Q. And construction has been going on throughout the year, is that right?

Q. Despite that fact, the construction schedule is not yet definite? A. That is right.

Q. Now what is there in the nature of the details of the problems of construction which has prevented Commonwealth Associates and PRDC from arriving at a definitive construction schedule?

[3465]

A. Some of the design work has not been completed. There are items as to which additional research work is required.

Q. What design work has not been completed? A. Do you want me to try to give you specific items? One that comes to my mind is—

Q. Well, are you in a position to testify— A. If you

will let me answer, I will say that one that comes to my mind as an example is the Cask ear. That is under study at the moment by Dr. Zinn's organization. And the study has not yet been completed.

The design has not been made of it. So that we have nothing definitive on which to ask for bids. That situation has to be reappraised to fit into the construction schedule. There are additional items of that kind.

Q. What additional items do you know about? A. The fabrication of the fuel elements. Those are the ones that come to my mind immediately.

Q. Who would have more detail on the problems? A. Mr. McCarthy would.

Q. He would know which items have not yet been designed or the designs have not been completed? A. He would be more qualified to testify along those lines than I am.

Q. In addition to design problems, what other problems

[3466]

are there that have delayed the schedule? A. I think it would be principally design.

Q. I understand, but what other problems are there besides design? A. That caused the delay?

Q. Yes, that make it impracticable to determine a specific construction schedule. A. I have not said it was impractical to determine a specific construction schedule.

Q. Or which has delayed the determination of a schedule? A. I don't know of any other items, Mr. Sigal. As I said, I think the delay would be principally because of the design problem.

Mr. Claytor: Excuse me. I think Mr. Acker is speaking of the delay in the construction.

I think that Mr. Sigal's question, if I understood it correctly, which was a little difficult to understand, is why we do not yet have a new revised definitive construction schedule. That is a delay in the creation of the schedule as distinguished from the delay in the construction. Is that right?

Mr. Sigal: Yes.

The Witness: I thought I answered that previously, Mr. Sigal. I thought I said that was under way at the moment.

[3467]

Whatever time it takes to revise the construction schedule based on the study of each individual item still to be fabricated, ordered, and so forth, whatever that delay is it is. Whatever time is required we have to stand for it.

By Mr. Sigal:

Q. Then so far as the schedule that is now indicated that also is a tentative matter? A. I stated that previously, yes.

Q. And there is no assurance in so far as PRDC itself is concerned that the construction of the reactor will be completed by September 1, 1960, is there? A. Nobody can ever have such assurance, Mr. Sigal.

Q. Of course, if the construction is delayed beyond what you now indicate, of course your construction costs will be increased beyond those that you now estimate. Is that not true? A. I think it is entirely possible that



some element of your construction cost would be increased. Certainly your administrative cost during construction would be.

Again I would like to point out that we feel confident that the \$6,000,000 that we have available would cover such a delay as well as unforeseen increases in cost.

Q. Now I call your attention to Exhibit No. XLV.

A. I have it, Mr. Sigal.

Q. Now this exhibit is entitled "Comparison of the

[3468]

Construction Estimates and Commitments." And it shows the comparison of the major items involved in the construction of the reactor and concludes with a showing that the overrun at the present time comes to 7.4 per cent. A. That is right.

Q. However, if you would examine the individual items, Mr. Acker, the over-run on the large items particularly is far greater than 7.4 per cent. A. That is true.

Q. For example; I call your attention to the liquid metals, item D-3, intermediate heat exchanger, the over-run there is 183 per cent.

In the case of two loops, primary sodium piping, the over-run is 147 per cent.

In the case of the secondary containment, the primary sodium system, over-run is 300 per cent.

Mr. Morrisson: Is that an over-run of 183 per cent?

Mr. Claytor: It is 183 per cent of the original cost estimate.

Mr. Sigal: I don't think we need comments from everybody around the table, Mr. Examiner. I am

only reading what this says. If the witness wishes to correct what appears on the exhibit, he can correct it.

Mr. Morrisson: I just wanted to have it correct in the record.

[3469]

The Witness: I will state that your statement is incorrect as read from the exhibit. The 183 figure that you see, if you look at the top of the column, it is percentage of the estimated cost represented by the Order or commitment, so that that would be an over-run of 83 per cent.

By Mr. Sigal:

Q. The statement there is 183 per cent of the original cost? A. That is right.

Q. And the two loops of primary sodium piping shows 147 per cent of the original cost.

The secondary containment of the primary sodium system shows 300 per cent of the original cost.

Now, the liquid metals system shown on this schedule is far and away the largest item on the schedule, is it not, intermediate heat exchanger. A. That individual item is the largest on the schedule, yes.

Q. Now it appears, does it not, from this schedule that the over-run is found primarily in the reactor items themselves rather than in the, shall we say normal construction cost? A. That is true.

Q. So far you have had experience with these costs, so far as in construction, improvement, excavation and so forth,

[3470]

your estimates were fairly sound. A. Yes.

Q. As to the item with respect to the reactor, it appears that your estimates were quite low compared to what the costs turned out to be. A. On the basis of these individual items, that is correct.

Q. Under the circumstances, to say that your overrun is only 7.4 per cent is stating an average which does not reveal the significant problem of estimating the costs of the unique structures involved in this reactor, isn't that right? A. I agree fully that it is an average and the nature of an average is that it does not reveal the individual items which make it up.

Q. It would also appear, would it not, that as time goes on and you get into the manufacture of the items which are of this unique variety, namely, the special components of the reactor, it would appear that your estimates are likely to understate the cost in the same order as you understated them with reference to the liquid metals system? A. No, I don't agree with that, Mr. Sigal.

Q. Why don't you agree with that? A. Just because that has happened with respect to individual items here does not mean that it will obtain

[3471]

throughout the balance of the construction schedule.

Q. But the point I thought you agreed with me on was that when you were getting to the manufacture of the unique items as I call them, your estimates have proved to be quite unreliable. A. As to those that are presented here, that is true.

Q. What reason is there to expect that your estimates will prove more reliable with regard to the same type of component parts that you have not yet come to? A. Because there is no reason to expect otherwise. It seems to me it is entirely open-ended, Mr. Sigal. I can not say as to whether all the balance of the items in this category would be equally under-estimated.

Q. I did not say that you can say, Mr. Acker. I am suggesting that you are also in no position to say that they will not be under-estimated to the same extent. A. I will agree with that. But I think it would be unreasonable for me to make either statement, Mr. Sigal. They will be what they are and again I would like to urge that we feel that we have adequate resources to cover them, whatever that may be.

Q. Of course you will recall, Mr. Acker, that when you testified several months ago that you were quite confident that the estimates that you reported then were sound. You remember that?

[3472]

A. Yes, I do.

Q. You had no reason at that time to believe that the costs would be substantially greater than you estimated them at that time to be.

Now you do have experience and your experience shows that with respect to these more complicated items, items in which manufacturing experience is extremely limited, your estimates have proved to be quite unsound? A. As to these particular items, that is true.

[3473]

Q. Now, are you in any position to give any estimate—perhaps you have already answered this question before—are you in any position to report any estimate with respect to the extent to which your construction costs will exceed your previous estimates? A. No, I am not, Mr. Sigal; at this time.

Q. Is anybody in the PRDC organization prepared to do that? A. I don't think anybody is, Mr. Sigal. I will say again that it is our best judgment that the overrun will be under the resources that we have available to meet them.

Q. Now, on page 12 of your supplemental testimony you say, "No substantial additional material to be incorporated in the reactor has been placed on order by APDA since the preparation of Acker Exhibit No. 20."

When was that exhibit prepared, Mr. Acker? A. Where is that statement, Mr. Sigal?

Q. On page 12.

Mr. Claytor: Acker Exhibit 20, I believe the record will show, was prepared at the time of Mr. Acker's cross examination which I believe was in March. The record will show.

Mr. Sigal: The exhibit itself does not show. It was some time in March that this exhibit was prepared.

By Mr. Sigal:

Q. Your testimony then indicates that between March

[3474]

1957 and August 1957 no substantial additional material has been placed on order.

It seems to me to be a long time during the construction period not to have placed on order materials necessary for the construction of this reactor, Mr. Acker. Can you explain the reason for that? A. This applies to APDA, this statement, Mr. Sigal; not to PRDC.

Q. That is right. A. The fact is that APDA have covered the bulk or a substantial part of the test facility at that time.

Q. You say they have already placed on order the substantial bulk of it. Is that the reason they have not placed on order any more? A. I say that at that time they had placed a substantial amount of the orders for the test components, and no additional orders have been placed since then.

Q. That is what you say, but there is a substantial amount yet to be placed on order by APDA? A. That is right.

Q. Now, I ask you why, if you can tell us, APDA has not, during this intervening period of at least four months, placed anything more on order? A. Because they have not been ready to, Mr. Sigal.

Q. Obviously they have not done it. Do you know why

[3475]

they are not ready to do so? A. Because they still have some design and research work to do before the additional orders for materials are placed.

Q. Do you know on what items they are still doing design work which they are supposed to put on order? A. It would not necessarily be design. It could be design or investigation, but the orders have not been placed

as yet for the core. I think that orders have now been or are about to be placed on sodium pumps. That was another item that took long investigation and negotiation. I think those would be the principal items that have been delayed.

Q. Then your testimony is that the reason that APDA has not placed any orders in any substantial quantity since March is that the design has not yet been completed on those items? A. Or their investigation of a particular item has not been completed.

Q. So they have not gotten to the design stage, you mean, on some items? A. I do not mean that. I do not mean that no design work has been done on some of it.

Q. Isn't that what you mean by the investigation is going on? A. It could be an investigation on what manufacturer

[3476]

could fabricate the equipment.

Q. Now, at the bottom of page 12 of your supplemental testimony you say that you think that your estimates are more realistic than much of Mr. Radley's testimony seems to indicate. Is it your position, Mr. Acker, that Mr. Radley's estimates are not realistic? A. In some respects, yes.

Q. In what respects? A. To begin with, Mr. Sigal, in comparing estimates for large construction projects of this type, it seems to me that you must be sure that your basis is correct to begin with. I think that Mr. Radley's concept of a power reactor construction estimate was that of one organization undertaking to do the job begin-



ning from the beginning and carrying it through its construction period.

I would like to point out that in the PRDC case that is not the fact. APDA had done a great deal of work prior to the PRDC coming into the field, and in addition, APDA is carrying on extensive work for PRDC's account without charge, which would normally appear in a construction estimate where it was all being prepared and undertaken by one organization.

So I think that the basis for the comparison of our estimate with that of some other reactor project now being undertaken in the same way is invalid.

[3477]

For example, take the item I have spoken of, indirect and overhead expense. I think in addition, on an item of that kind, you would have to understand the character of the contract under which that kind of work is being undertaken. You will remember that our contract with the United Engineers and Constructors which this item of \$2,977,000 covers is on a non-profit cost reimbursable basis.

Mr. Radley has given estimates as to what the indirect and overhead expense would be on a project, I take it, that he was assuming that one organization did the whole job on a conventional basis. I would assume, with profit involved to the contractor who was doing the construction and erection.

In our case we estimate that saving to PRDC under our United Engineers contract as a result of it being on a non-profit basis—

Q. Who is on a non-profit basis? A. United Engineers and Constructors.

Q. They are doing this for you without any profit?

A. On a non-profit basis, cost reimbursable basis. We assume that if it were on the conventional basis, that we were hiring men to build a steam plant for a utility company, that the estimated cost would increase \$500,000 at least.

So that to get a comparable figure in our case for the usual concept of indirect and overhead expense, I think you would have to add that figure, at least.

[3478]

Now, in addition, APDA has undertaken to do research and other work for us during the construction period and their administrative expense during PRDC's construction period is estimated at \$2,250,000.

Q. What is that for, you say? A. That is the administrative expense of APDA during PRDC's construction period.

Q. \$2 million? A. Right.

Q. For administrative expense alone? A. For administrative expense during the PRDC construction period.

Q. You mean out of a total contribution of \$7 million— A. This is in addition to their \$7 million. This is an expenditure on their part for administration and overhead during our construction period beyond their commitment to us which we have valued as \$7 million.

Q. How do you arrive at that figure? A. I get it from their budget for the next three years. That is in evidence in this proceeding.

Q. Is there anything in evidence in this proceeding showing that? A. There is; yes, sir.

Q. Will you point out what you refer to?

Mr. Claytor: This is derived from Acker Exhibit 4.

[3479]

By Mr. Sigal:

Q. Acker Exhibit 4 shows a total of \$2,257,979 for the period beginning 1/54. A. That is right.

Q. Construction in this case started late in 1956, did it not? A. Yes, but it depends on what you call your construction period, Mr. Sigal. This character of project there is a great deal of work that has to be done before you actually begin to dig a hole in the ground.

I think it is reasonable to assume that that is the first part of your total administrative and overhead expense on the project.

Q. Of course, Mr. Acker, you testified earlier that APDA is doing things other than working for PRDC and the administrative expense indicated here is the total administrative expense, is it not? A. That is right.

Q. There is no allocation in this thing to which you refer of the administrative expenses relating to the PRDC project? A. That is right. I gave you the approximate figure. The proportion of the total cost, total expense budget, to the amount which is allocated to other items and those for the benefit of PRDC is very small.

[3480]

Q. Of course, you make that statement, Mr. Acker, but you have not presented, so far as I am aware, any break-

down showing what the expenses are with relation to each of the projects handled by APDA.

Now, Mr. Acker, you, I assume, read the testimony that Mr. Radley gave? A. Yes.

Q. You are aware that Mr. Radley made his estimates on the basis of his experience of many years in the building of reactors? A. Yes.

Mr. Morrisson: Mr. Examiner, I would like to correct the record on one point.

There have been several references to Mr. Radley's estimates. I think his testimony was very clear that he was not making estimates; that he was making certain comments on the estimates furnished by the applicant, but he did not feel in a position himself to make any estimate of the cost of construction of this reactor.

Mr. Sigal: I did not say he made any estimates about the reactor cost. He did make estimates about the cost of certain items.

Mr. Morrisson: The record will show what it shows. I don't think he did.

Mr. Sigal: All right. Your comment is well taken.

[3481]

the record will show.

By Mr. Sigal:

Q. Now, Mr. Acker, your own testimony, as shown in this supplemental statement, goes into some items, but does not refer to a number of other items that Mr. Radley did mention.

For example, he stated in his testimony that PRDC substantially under-estimated the cost of on-site labor. Now, you have made no reference to that. Are you in any position to state wherein Mr. Radley's testimony was in error? A. I can point out certain areas which I think he had no knowledge of, so that would necessarily be taken into account when he stated that a more usual relationship between total cost and on-site labor would be 6 to 4 as against our 18 to 5.

To begin with, there are items totaling \$3,742,650 that were estimated on an installed basis, an overall basis for each item. For instance, a building might be estimated at so much per cubic foot with no breakdown specifically, no definitive estimate as to labor and material relationship.

In those cases, there are all of these items totaling that amount where in order to arrive at a labor-material division in the estimate, we simply made an arbitrary division of labor and material. That may be in error, so that that can be a reason for a part of the difference, if the comment is

[3482]

valid.

In addition, there is some \$887,000 of items that were estimated on an installed overall cost basis with no breakdown of labor and material and, therefore, the whole item shown under the material column. Now, as to those things, I don't know the extent to which they would influence Mr. Radley's thinking if he knew them or would modify our material-labor relationship or ratio which he commented on.

I merely want to point out that they are two reasons that our ratio might not be comparable to somebody else's ratio.

Q. As events turned out, Mr. Acker, it appears that you did seriously under-estimate certain of your costs with reference to your on-site labor. For example, referring to Exhibit XLV, with respect to structures and improvements, there was an overrun of 13 percent on your dredge and grade fill. There was an entire item for which you did not make any provision at all with respect to dewatering the excavation, which is probably substantially on-site labor.

These two items alone, on the basis of your own figures, total \$64,000 out of a total for structures and improvements and reactor plant structures of less than \$300,000.

A. Mr. Sigal, in the first place, I think it is entirely invalid to assume that the overrun on the dredge and grade fill item is because of on-site labor. I think it can

[3483]

perfectly well be the difference in the quantity of the fill involved.

Q. My statement was made with reference to the dewatering excavation as being largely on-site labor. A. You called my attention to the dredging and grade fills and said that was a 13 percent overrun and implied it was because of an overrun on on-site labor.

Q. I am not arguing with what you have said, Mr. Acker. The point is that you have \$64,000 which you will agree, would you not, that a substantial part is on-site labor? A. I will not agree that a substantial part

of the overrun is necessarily on-site labor. It may be quantities of materials involved.

Q. Do you know, as a matter of fact, what this \$64,000 item for dewatering excavation consists of? A. That is an item, Mr. Sigal, that was not specifically set forth in the estimate, but was included originally in the provision for excavation, grouting foundations, and so forth, and I think that that, depending on how you make your estimating, is an entirely proper procedure.

We have set it forth because when we ran into the foundation condition, we found that there was some water that had to be continuously pumped and it became a very considerable item, more of an item than such incidental pumping would be in normal foundation work.

[3484]

Q. My question to you was— A. The greater part of this is not labor. It is continuous pumping of the water and the provision for the installation of such pumping equipment.

Q. Can you answer the question how much of that \$64,000 is labor? A. No, I cannot and I think it is unreasonable to ask me to.

[3486]

The Presiding Officer: The hearing will be in order.

Mr. Sigal, I understand that Mr. Acker wants to make a correction to some of his testimony yesterday.



Whereupon

ERNEST R. ACKER, the witness on the stand at the time of the taking of the recess, resumed the stand and, having been previously duly sworn, was further examined and testified as follows:

The Witness: I would like to correct a statement that I made on page 3474 and 3475 of the transcript. I said on page 3474 that while APDA had already placed, as of last March, a substantial amount of orders for test facilities components there still remains a substantial amount of such orders unplaced.

Actually, if you will compare Acker Exhibit No. 6, which lists the components to be purchased by APDA for components testing and then turned over to PRDC with Acker Exhibit No. 20, which lists the material on order last March, you will see that some 90 percent of the items to be purchased in terms of their estimated cost without contingencies are in fact on order by APDA.

The items of equipment which are not on order shown in Acker Exhibit No. 6 are the element transfer rotor and drive, the reactor plant instruments, accessory electric equipment and the initial operating supplies.

[3487]

Also on page 3475 where I referred to the core and the pumps not being on order, I was referring to APDA, whereas I should have been referring in

the context to PRDC. These items are ones that will be ordered by PRDC except for one sodium pump which APDA is buying and which on Acker Exhibit No. 20 is shown to be already on order.

The Presiding Officer: Very well, Mr. Acker. Did you get that, Mr. Sigal?

*Cross Examination—Continued by Mr. Sigal*

Q. I am not certain that I got all of what Mr. Acker said because he started off before I was aware of what he was talking about. If I understood you correctly, Mr. Acker, you were listing the items that were on order as of March 4th, was it? A. Whatever it was.

Q. 1957. The ones that were not on order. You do not intend, I gather, from what you said, to change your earlier testimony yesterday to the effect that no substantial amount has been placed on order since March 1957. A. No, but I do want to change my testimony to the effect that some substantial amount still has to be placed on order. The gist of what I am saying now is that I was incorrect in my statement and that there is not a substantial amount still to be placed on order which was not on order last

[3488]

March.

Mr. Claytor: By APDA.

By Mr. Sigal:

Q. Only with reference to APDA? A. That is right. That is where the confusion arose.

Q. Only with reference to the list in evidence on Acker Exhibit 20 to which you are now referring. A. Yes, but of course that lists all the items that APDA will order for the test facility and turn over to PRDC.

Mr. Sigal: Will you read that?

(The answer was read by the reporter.)

By Mr. Sigal:

Q. Acker Exhibit 20. A. Yes.

Q. And the other items that you mentioned in your testimony a moment ago are in addition to those items?

A. No, those are the items on Acker Exhibit 20 which are not yet on order.

Mr. Claytor: Could I correct that? We are referring to the wrong exhibit. It is Acker Exhibit 6 which lists all the items and Acker Exhibit 20 which lists the items which were already on order.

By Mr. Sigal:

Q. To which exhibit are you now referring other than 20? A. I am referring to Acker Exhibit 6. The items that

[5433]

I have listed as not on order are those shown on Acker Exhibit 6.

Q. What you want your testimony to show now is that so far as what APDA is obliged to turn over to PRDC there is not now a substantial amount of material and equipment to be put on order. A. That is right. In fact, in excess of 90 percent of the dollar value is already on order.

Q. You have no knowledge of when those items will be delivered? A. I have not as to the specific items except in the case of the reactor vessel and plug.

Q. We were asking at the close of the testimony yesterday, Mr. Acker, certain items that Mr. Radley had mentioned in his testimony. A. Yes.

Q. I think your last comment to one of my questions was that it was unreasonable. A. I will do my best to give you an honest answer. I gave you an honest opinion yesterday.

Q. Now, Mr. Radley pointed out that your statement states the cost of engineering design and expenses at \$900,000. He stated that his opinion is that that figure should be at least twice as high. Are you still standing on the figure of \$900,000 for that service?

[3490]

A. Yes, we are, Mr. Sigal, and here again we have the highest regard for Mr. Radley and his ability in his field, but I would like to say in fairness to our presentation that I think Mr. Radley again is talking in terms, when he makes these comparisons, of a one-organization project where one organization does the whole job starting with the engineering, conceptual design and carrying through the construction. Here we have two organizations involved and Mr. Radley could not have this knowledge prior to his testimony.

Q. Mr. Radley was basing his testimony on your testimony and on the material submitted by PRDC. A. There are things, however, there are factors which do not appear in my testimony which I am sure would have in-

fluenced Mr. Radley in his thinking in making these comparisons if he had had them before him. Those items I would like to point out to you.

Q. Are you now talking about engineering design expenses? A. Yes, I am.

Q. What do you allocate to APDA expenses for engineering design in respect to the PRDC reactor? A. Of course, APDA has done all the designing and a great part of the engineering in connection with the reactor project. They have already spent \$2 million through 1956, at which time more than a third of the work had been done.

[3491]

I do not have a breakdown of exactly what APDA had spent on engineering and design, but I would like to point out that in addition to our \$900,000 that they have done a very substantial amount of engineering design work and will continue to do so, which does not appear in the construction estimate or cost of the project. In addition, I would like to point out that again the Commonwealth associates who are doing the engineering and design work to be undertaken by PRDC, are doing the job on a no-profit, no-overhead basis. If we had engaged an engineering firm on the basis of profit and overhead we estimate that it would have cost us \$500,000 more and I think that is fair to assume that Mr. Radley in his considerations assumed that we would engage or that this engineering and design work would be done on the usual profit basis.

Q. Now, presumably we can get Mr. Radley to testify, I assume, and Mr. Radley based his estimates and opin-

ions on what PRDC offered in this case. A. That is right.

Q. On the evidence, on your statements, on exhibits and whatever else there was in the case. Now, if Mr. Radley and no one else presumably can come to any conclusion from what is in the case, Mr. Acker, then it is obviously impossible to arrive at any conclusion as to what the cost of this project will be. A. Well, I agree with you fully as to what you say on Mr. Radley. If these items were not in evidence in the case he

[3492]

couldn't possibly have knowledge of them.

Q. Now, Mr. Acker, you are offering an opinion now that if the Commonwealth Associates did this on the basis of a profit and overhead that the cost would be \$500,000 over the \$900,000 item. A. That is right.

Q. Do you have anything to back that up? Do you have any material to back up your opinion that it would cost \$500,000 more? A. Yes, I have the opinion of the staff of APDA, and my own knowledge of what engineering firms charge for the profit and overhead. My own company is now engaging an engineering firm on a twice-payroll basis which is materially in excess of what the charges are under this contract.

Q. Do you have personal knowledge, Mr. Acker, of what items went into the \$900,000 figure that has been submitted heretofore and what items would go into the \$500,000 figure that you say would have to be added if these other considerations were involved, namely profit and overhead expense? A. I say, Mr. Sigal, that the

\$900,000 is our best estimate of what the Commonwealth Associates' direct payroll costs will be.

Q. You mean it is your estimate? A. May I finish?

Q. Or the Commonwealth Associates'? A. Our combined estimate based on a manhour study.

[3493]

Q. Then you don't have an estimate from Commonwealth Associates of what their charge for engineering design and expenses will be, is that correct? A. No, because, as I said, it is on the basis of reimbursable direct costs of the figure of \$900,000 is an estimate of what that will amount to to cover the whole job on the basis of the number of manhours that they estimate the job will require.

Q. That is your estimate? A. That is their estimate.

Q. Do you have a document from Commonwealth Associates stating the basis for their estimate? A. I do not know if there is such a document in existence, Mr. Sigal.

Q. So far as the figure you mentioned for APDA is concerned, that certainly goes back, the figure you mentioned includes expenses going back to 1954, doesn't it?

A. That is right.

Q. Substantially before this particular reactor was licensed or a permit was issued by the AEC in this case and substantially before you applied for a permit in this case, is that correct? A. Well, I don't want to be bound to the word "substantially", but before, certainly.

Q. And that, of course, covers the general experimental



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work that APDA was doing on fast reactors. A. It included a lot of design work as well. Mr. Sigal, directly related to the definitive reactor plan for this project.

Q. Directly related to what? A. To the definitive reactor plan for this project.

Q. Are you saying, Mr. Acker, that in 1954 you had a definitive project to place a reactor at Lagoon Beach?

[3495]

A. No, I am not saying.

Q. Then it could not have been a design for this particular reactor that we were working on in 1954? A. It most certainly could. Much of the engineering and design work which they did was directly related to the reactor design as it is now contemplated and to be built.

Q. But it also included general experimental development work on fast reactors? A. Yes, such as you would have to do in preparation for any reactor project.

Q. Now, Mr. Acker, I assume you are not familiar with any other reactor projects than PRDC's; is that correct?

A. Except in general, Mr. Sigal.

Q. By "in general", you mean that you know that there are other reactor projects in existence? A. Oh, much more than that, Mr. Sigal.

Q. You have no personal knowledge of other specific reactor projects, do you? A. Certainly I have.

Q. To what extent? A. Mr. Sigal, there is a great deal of literature about all of these projects and I have kept myself informed in general as to the character of these reactor projects.

Q. You are now talking about in general, the reactor projects in general, not with respect to the specific problems

[3496]

construction and design? A. Not through my personal knowledge, but I have through discussions with people in the industry.

Q. All right.

Now, Mr. Acker, Mr. Radley testified with reference to your estimate of \$34,500 for a waste disposal system. He testified that that was unlikely that an adequate waste disposal system for a reactor of this type and size could be obtained for any amount close to that estimated. A. We couldn't agree more with Mr. Radley. This is clearly in error.

Q. It is an error? A. An error.

Q. You have changed it? A. Yes, we have.

Q. Where does it appear? A. Our estimate now is two hundred thousand dollars.

Q. Where does that appear? A. It does not appear except as I am stating it for the record here today. We have not modified our construction estimate.

Mr. Morrisson: Excuse me just a moment.

What is this estimate you were changing?

The Witness: The waste disposal system and we say we cannot agree with Mr. Radley more. It is clearly an error,

[3497]

and we have modified our estimate to the effect of a cost of two hundred thousand dollars.

By Mr. Sigal:

Q. Is that the only item in your estimate that you changed? A. We haven't changed any item nor estimate as yet.

Q. I am sorry. A. We have not changed any item nor construction estimate as yet, Mr. Sigal.

Q. Do you mean you haven't even changed this item? A. We haven't changed any, nor construction estimate.

Q. What is this two hundred thousand dollar figure that you just gave? A. The two hundred thousand dollars is our present estimate of the cost of this project. What I am saying is that we have not changed any item in the estimates as submitted in the proceeding.

Q. You mean you haven't changed any exhibit with respect to your estimate? That is what you mean? A. I stand corrected.

Q. I see.

Are you suggesting, then, that you have changed your estimates in regard to various items on your construction items?

[3498]

A. In our own thinking, you mean?

Q. Yes. A. Why, certainly, where we know that there are changes. Some of them are reflected in exhibits which are in this proceeding, which have been introduced in this proceeding.

Q. I am sorry, Mr. Acker. I am not aware of just what exhibits you are indicating as showing changes in your estimates. A. We submitted an exhibit yesterday showing overages on certain items.

Mr. Claytor: Acker Exhibit 26.

The Witness: Obviously where we have already incurred overages as to certain items, the overall construction estimate must ultimately be modified.

By Mr. Sigal:

Q. We must be using words with different meanings. Obviously it is no longer an estimate when you have already paid out the money for an item. I am now talking about items which are not yet paid for, for which there is not already a specific commitment in dollars and cents.

Now, with respect to such items have you changed your estimate as to their probable cost? A. Not as yet.

Q. Have you changed the items as to the probabilities,

[3499]

at least with respect to your thinking about them? A. We know, of course, that there is an exposure to increases as to some items which have not yet been placed on order.

Q. Now, you have just indicated that you have changed your estimate with respect to the waste disposal system from \$34,500 to two hundred thousand dollars? A. That is right.

Q. Can you name any other items which you have changed similarly? A. No, I can't name any other items where there has been as yet a specific change made.

Q. The waste disposal system is the only one, then? A. That is the only one where a specific change has been made and agreed upon.

Q. Do you have a design for that waste disposal system? A. I think we have a conceptual design. I cannot say as to whether the design has been completed.

Q. Let me ask you this:

Do you have the design in any such form that Mr. Radley could offer an opinion on it as to its cost? A. I believe we have sufficient information and definitive conceptual design so that he could offer an opinion.

[3500]

Q. Do you have a design of any nature to offer us now?

A. Not here, no; I haven't any such thing available here.

The two hundred thousand dollar estimates listed are detailed so that I think that he could make an intelligent appraisal of our figure.

Q. May we have copies of those elements?

Now, Mr. Acker, looking at this revised estimate for waste disposal equipment.

Mr. Morrisson: Again could we have this marked, Mr. Examiner, with an identifying number so that we won't confuse all these papers?

Mr. Claytor: I suggest that a paper consisting of a single sheet entitled "Revised Estimate of Waste Disposal Equipment", be marked Acker Exhibit 27.

The Presiding Officer: That will be received for identification. That will be Arabic 27.

I noted that the Acker was Roman XXVI in the record yesterday. We want to correct that.

(Acker Exhibit No. 27 was marked for identification.)

By Mr. Sigal:

Q. Mr. Acker, this exhibit identified as Acker 27 gives a list of projected costs of certain elements of the

[3501]

waste disposal equipment. A. Right.

Q. As is obviously on the face of this exhibit it does not describe the elements, give their dimensions and materials and so forth so that it would be obviously impossible to determine the reasonableness of this estimate.

Now, I ask you, do you have any other material describing your waste disposal system? A. There is such material available, but I do not have it here.

Q. I see. And you do not, I assume, have personal knowledge so as to be able to describe it yourself? A. That is true, Mr. Sigal.

Q. Do you have any knowledge of how this compares to waste disposal systems that have been built for other reactors? A. No, I do not.

Mr. Sigal, could I give you a figure which you asked me for before, which I said I did not have available? You asked me what the allocation of engineering and design costs to PRDC job by APDA is. APDA has actually spent, allotted to engineering design on the PRDC job, through 1956, \$977,224. Its budget expenses for the 1957 through 1958, the PRDC construction period for engineering and design, is \$781,762, making a total of \$1,750,000-odd.

[3502]

Q. Going back to what year, Mr. Acker? A. 1954.

Q. 1954? A. Yes, but if you will take just what they propose to expend during the construction period and add it to our own estimate of our own engineering design, you will see that we can readily agree with Mr. Radley that the overall engineering design expenditures on this

job will be in the nature of a minimum one million eight hundred thousand dollars.

Mr. Morrisson: Mr. Examiner, I assume that Mr. Acker was reading from a document which I suspect is a document of which I already have a copy, entitled, "Actual and Anticipated Expenditures by PRDC and APDA, Combined, Applicable to PRDC Reactor Project."

I intend to ask that that document be marked for identification in any event, and wonder if it might not simplify this to have it marked now.

Mr. Claytor: I ask that the document described by Mr. Morrisson be marked for identification as Exhibit Acker No. 28.

The Presiding Officer: The document so described will be marked Acker Exhibit 28 Arabic, for identification.

(Acker Exhibit No. 28 was marked for identification.)

[3503]

By Mr. Sigal:

Q. Referring to Acker Exhibit 28 for identification, the figures you have just read are described as follows:

Item C-1, and item C-2, it is stated that APDA actual expenses for engineering and design, in addition to those included in the Commonwealth Associates estimate, are \$977,224, and that is derived as this exhibit shows by taking simply eighteen percent of a figure of \$5,400,000-plus, which is called research and other test expenses; is that correct, Mr. Acker? A. That is right.

Q. So this is some sort of rule of thumb by which you



determine how much is applicable to the PRDC engineering and design, and how much is applicable to other matters?

[3504]

A. It is a percentage which reflects a study by each year, 1954 through 1956, of the allocation of APDA's costs between engineering and design and other research and test expenses and that is a composite percentage reflecting the results of those studies.

We think it is a comparatively reasonable allocation of the total cost to engineering and design expenses.

Q. But it is still more or less some sort of rule of thumb that you apply in order to arrive at this figure? A. No, it is more than a rule of thumb. It is based on actual studies of the direct costs chargeable to these specific expense accounts.

Q. You are not personally familiar with the accounting details or determination of these costs, are you? A. I know how they were determined, Mr. Sigal, but I did not sit down and do it, myself.

Q. Nor did you examine the figures from which these were derived? A. No, I did not.

Q. And you have no personal knowledge of what is covered by this item research and other test expenses? A. Well, to the extent that I have knowledge of the work done by APDA, yes.

Q. Well, what does research and other test expenses cover?

[3505]

A. Well, APDA is conducting research on many items in connection with this reactor project.

Q. And it is also conducting research with regard to matters not relating to this reactor project, isn't it? A. Not in this period that we are talking about, no.

Q. Not at any time up to 1956 did they concern themselves about anything else but PRDC? A. That is right.

Q. PRDC wasn't in existence in 1954? A. Well, again we are talking about terms. Everything that APDA has done up to now has been directed to the formation of PRDC and to the project which it is now carrying forward.

Q. APDA, according to the record, according to your own testimony, Mr. Acker, was concerned in general, at least in part, with developing fast reactors? A. That is right.

Q. And it is your opinion then that anything dealing with a development of fast reactors has a bearing on the PRDC project? A. There is no question about that, Mr. Sigal. I will put it this way: that I think PRDC if it had been formed in 1954 would have had to go through exactly the same motions that APDA was going through to cover exactly the same fields.

[3506]

Q. Mr. Acker, are you offering an opinion as a scientist in this matter? A. As a scientist?

Q. Yes. A. I don't think it needs a scientist to offer that opinion, Mr. Sigal.

Q. You mean it doesn't need a scientist to determine what sort of experimental and developmental work is required? A. That isn't the question that I am directing myself to. I am saying that whatever that research and development work, or test work, might be, that PRDC would have had to go through the same thing that APDA

is going through in preparation for the design and construction of this reactor.

Q. You are offering that, I gather, as your opinion, Mr. Acker? A. That is right.

Q. All right.

Now, Mr. Acker, looking at the second item under C, it states that APDA budgeted expenses for 1956 and 1957 are \$781,762. Does that relate to engineering and design expenses? A. That does.

Q. All right.

Then, it says:

"This is eighteen percent of sixty-six and two-

[3507]

thirds percent of six and a half million dollars which is budgeted for research and other test expenses."

Now, that, of course, is projecting this matter into the future? A. That is right.

Q. How do you arrive at eighteen percent of sixty-six and two-thirds percent? A. By the same kind of study as the prospective charges applicable to other research and test expenses, and to engineering design.

Q. Why do you fake— A. Mr. Sigal, let me say this: That we have been asked to make this estimate and we have made it in accordance with our best judgment.

Q. You didn't make the estimate, did you? A. I did not, no.

Q. All right.

Now, I am asking you what is this sixty-six and two-thirds percent item? A. That is the portion of the pro-

jected expenditures research and other test expenses for the years 1957 through 1959, applicable by APDA to PRDC.

Q. Applicable in general, not merely to engineering and design?

[3508]

A. No, they aren't. In general. Now, we are saying that of the amount of APDA's expenditures applicable to the PRDC job, eighteen percent will represent engineering and design, and that is our best estimate.

Q. And this eighteen percent for those years is carried forward from the experiences you had for prior years?

A. That is right.

Q. In determining what engineering and design expenses would be? A. That is right.

Q. So it isn't related to specific knowledge, as to how much you will actually be required to spend for engineering and design? A. It can't be because we are talking about the future, Mr. Sigal.

Q. Now, to what purposes will the balance of one-third of the six and a half million dollars be devoted? A. To research work in other fields than directed at this particular project. It would cover their advanced planning projects.

Q. So then this one-third of six and a half million dollars will be devoted to matters other than the PRDC project? A. That is right.

Q. Now, are you in any better position than you were yesterday, Mr. Acker, to tell us what those projects are

[3509]

which will be covered by this one-third? A. My under-

standing is that those projects relate to research and development of plutonium fuel cycle; in other words, the use of plutonium as a fuel in a fast breeder reactor as against uranium.

Q. That is what you said yesterday? A. Yes.

Q. You are not adding anything to what you said yesterday? A. No.

Q. Now, I call your attention to item B, on Acker Exhibit 28, which is called administrative and overhead expenses. A. This apparently charges to PRDC \$2,170,000. It is not clear on this statement for what period that is intended. Can you tell us?

Q. The figure of \$2,170,000 is the estimate of PRDC's administrative and overhead expenses during construction period of the reactor.

Q. All right.

Now, this exhibit indicates that the estimate of the expenses has been increased to the present figure from \$1,816,000? A. That is right. That is what I testified to yesterday.

Q. Yes.

[3510]

A. In connection with the stretchout period.

Q. All right.

Now, what does it cover. What does this additional item or roughly \$360 thousand cover? A. It covers salaries and other overhead expenses.

Q. For what period of time? A. For the additional nine months which I testified to yesterday.

Q. Now, you have item A, estimated plant costs of

\$31,675,000 on this Acker Exhibit 28, an increase of \$460 thousand over the previous estimate? A. Yes.

Q. That refers to financing costs, doesn't it, that item of \$460 thousand? A. I didn't understand the question.

Q. What does that item cover? A. That is the item I testified to yesterday in application Exhibit XLIII, the new estimate presented to PRDC by Commonwealth Associates reflecting the additional administrative and overhead costs because of the stretchout of the construction period.

Q. I asked you what does it cover. You have an item of four hundred thousand dollars—some applicable to administrative and overhead expenses. Can you break the figure down?

[3511]

A. Yes, if you will give me some time.

Q. Pardon? A. If you will give me some time. You are asking me to break down an increase, so I would have to compare the new construction estimate with the old and show you the difference in the figures, which I will be glad to do.

Q. Is there any figure involved now showing how that item is broken down? A. How the item of increase—

Q. Yes. A. No, it is not presented in that way. There is the old estimate and the new estimate and to get the specific increases in each individual item you would have to compare the two estimates which I will be glad to do.

Q. All right.

Mr. Claytor: May I suggest that we do it at the recess.

The Presiding Officer: We will be in recess for a minute or two.

(A short recess was taken.)

[3512]

The Presiding Officer: The hearing will be in order, please.

Mr. Acker, were you able to make the calculation during the recess that Mr. Sigal desired?

The Witness: I can give it to him right now.

The Presiding Officer: All right, sir.

The Witness: Mr. Sigal, you have asked me for the breakdown of the \$450,000 increase in the construction estimate of Commonwealth Associates. That is made up of a \$300,000 increase in interest during the construction period and \$150,000 increase in local taxes, making the total of \$450,000.

By Mr. Sigal:

Q. Now, did you refer to this \$450,000 before as administrative and overhead expenses? A. What is that?

Q. Did you refer to this \$450,000 before as administrative and overhead expenses? A. If I did it was a mistake.

Q. I see. A. It was a slip of the tongue. There is an increase in administrative expenses from \$1,816,000 to two million some dollars.

Q. Maybe my recollection was not clear. I thought you had solidified that amount. A. No.

[3513]

Q. All right. Then, Mr. Acker, apparently, although this estimate is pretty fresh, dated July 31, 1957, it doesn't



include, for example, the \$200,000 figure that you indicated earlier for your increase in estimated costs of the waste disposal system. A. That is right. It does not include any modification of the original estimate except to the extent that I have indicated.

Q. Well, now, what is the reason for not indicating such increases which you have already determined will occur, Mr. Acker? A. It doesn't seem essential to us to modify the whole construction estimate for one item, a known increase from \$34,500 to \$200,000.

Q. You saw fit to make other changes. You saw fit to include an item of \$150,000 for local taxes. Now, isn't a \$170,000 increase for the waste disposal system a considerable item that is worth some attention? A. Mr. Sigal, I take it when we know more about our exposure to other increases over our estimated costs that we will, for our own purposes, modify our construction estimate and I want to call attention again to the fact that we have a very material margin over and above our present estimated cost to cover the kind of contingencies that we are talking about.

[3514]

Q. Well, Mr. Acker, PRDC's own interest isn't the only determining factor in the question of whether or not you will reveal to the Commission what your costs are. It is your obligation to reveal to the Commission what your estimated costs are so that the Commission may determine whether or not you are financially responsible. I am now talking about PRDC, not Mr. Acker. Don't you think under those circumstances that you are under an

obligation to reveal what PRDC has already found to be necessary, such changes as PRDC has already found to be necessary in its estimates? A. Mr. Sigal, PRDC will meet all of its obligations so far as revealing its costs are concerned, but I would like to suggest that we could make a new construction estimate every day, every time there is some new element that is entering into the picture, and how often do you do it?

Q. I don't know how often. A. We did it in this case to indicate what the effect of the stretch-out of the construction period would be, assuming that the balance of the estimate remained the same. We did it so that the exhibit would tie in with the other exhibits in this proceeding.

Q. Mr. Acker, you have offered some supplemental testimony? A. Yes.

Q. Which has changed much of what you testified earlier

[3515]

in a number of respects. These changes presumably were brought about by changes in circumstances since you last testified. Why do you consider the construction estimate to be somehow immune from such changes, at least so far as revealing what is in your mind or the minds of PRDC officials at this time with respect to your prospective costs?

A. I do not consider it to be immune, Mr. Sigal. I am saying that for practical reasons you could change your construction estimate every day and it doesn't seem to us that that is essential inasmuch as we show from the standpoint of our resources such a material margin over and above the indicated requirements.

Q. How do you know or how is anyone else to know, Mr. Acker, whether or not your reserves are sufficient to meet the possible increases in costs if you are unwilling even to indicate here what you now expect those costs to be?

Mr. Claytor: I object to that question. There is no indication of unwillingness to reveal what costs are to be and, Mr. Examiner, this is just developing into a philosophical argument between Mr. Sigal's approach to the whole problem and that of the witness. It seems to me that that line has gone far enough.

Mr. Sigal: This is quite basic to this case, Mr. Examiner. The question of what it will cost to build this reactor obviously goes to the question of the financial

[3516]

responsibility of PRDC. This witness has already indicated with respect to one item, only one item, a substantial change in estimated cost. He has already indicated that there will doubtless be changes in other costs with respect to construction.

The Presiding Officer: You may proceed. I am not stopping you.

By Mr. Sigal:

Q. Will you answer the question, Mr. Acker? A. May I have the question read?

(The pending question was read by the reporter.)

The Witness: Mr. Sigal, nobody ever knows, looking into the future, whether a reserve is sufficient. I would be the first one to admit that. This

is a judgment matter and it is the same kind of situation that any corporation finds itself in when it is beginning operation: What do you provide, how often do you review and change your construction estimate during the course of construction?

By Mr. Sigal:

Q. Mr. Acker, you yourself, that is, PRDC, has already elected to review its construction costs. A. I beg—

Q. May I finish my question, please. You have offered in evidence here a letter marked Exhibit XLV, which indicates a change in your construction costs and you have offered other related exhibits showing changes. Now, doesn't that reveal that

[3517]

you have been reviewing your estimated costs? A. I stated previously, Mr. Sigal, that this new estimate of Commonwealth Associates was made to reflect the increases as a result only of the stretch-out of the construction period.

Q. But, be that as it may— A. That was the purpose of it.

The Presiding Officer: Just a moment, Mr. Sigal.

The Witness: That was the purpose of it and the Commonwealth review does not purport to be a re-estimate of the reactor plant cost.

By Mr. Sigal:

Q. Then, Mr. Acker, is it correct to say that your Exhibit, Acker Exhibit No. 7 and its related exhibits, which purport to show your construction estimates, do not reflect as of today the expectations of PRDC with respect to its

construction costs? A. I will say, Mr. Sigal, that it is entirely possible that that cost estimate would be exceeded.

Q. Then, your answer to my question is those exhibits do not reflect the expectations of PRDC with respect to construction costs as of today. A. I think we are getting down to a question of terminology. I would like to say yes, that they reflect our expectations, our hopes certainly, but I am perfectly willing

[3518]

to admit that the estimates may be exceeded.

Q. No, Mr. Acker. That is not what I am asking you.

In the light of your testimony is it not correct to say that your estimates are not now correct with respect to your own expectations? A. I don't think I will say that.

Mr. Claytor: That question has been answered.

The Witness: I don't know, Mr. Sigal.

By Mr. Sigal:

Q. You have already testified, Mr. Acker, that there is a two hundred thousand dollar item which is not included in those estimates? A. It is entirely possible that some other item may be reduced by two hundred thousand dollars, Mr. Sigal. We don't know. We are talking about the future.

Q. You also indicated earlier, Mr. Acker, that there were other items than the waste disposal system in which you anticipate that there will be increases in costs? A. That is right.

Q. But you have declined to indicate what those items are? A. I have declined because they have not been definitively reviewed as yet.

Q. What are those items? A. I think there is an exposure to an increase as

[3519]

as against the construction estimate in the cost of the core. There is an exposure to an increase in the cost of the sodium pumps.

I think there may be an exposure as to some increase in the cost of the cask car.

You already know about our revision of the waste disposal system estimate.

We think there is an exposure to an increase in the cost of the boiler.

Those are the principal items which have been reviewed in a preliminary way.

Q. I am sorry. A. Those are the principal items that have been reviewed in a preliminary way.

Q. They have been reviewed, you say? A. In a preliminary way.

Q. What does your preliminary review show as to the amount of the increase over your previous estimates? A. I am not in position to testify to that, Mr. Sigal, because the review has not been completed.

Q. I am sorry; I missed that. A. I am not in a position to testify as to that because the review has not been completed.

Q. I don't know that I understand you. You did say you made a preliminary estimate?

[3520]

A. I didn't say preliminary estimate. I said preliminary review.

Q. And none of it has been completed? A. We have no definitive figures as yet as to what these overages may be in those categories.

Q. You are not in any position to give us any preliminary figures? A. No.

Q. Well, now, Mr. Acker, Mr. Radley testified that with respect to the PRDC estimate for preoperational testing that the one hundred thousand dollars allocated for plant equipment adjustments is too low.

He testified that in his experience this one hundred thousand dollar allowance for plant equipment adjustments should be doubled or tripled.

From your testimony I conclude that PRDC has made no change in its estimate for plant equipment adjustment. Am I right on that? A. That is right, and PRDC does not think that that is necessary.

Q. Why? A. Because particularly for the reason which Mr. Radley could have no knowledge of that APDA will run this test facility as to very important components of the reactor plant and will during that period do plant adjustment work which is

[3521]

not reflected in the one hundred thousand dollars of PRDC's costs.

APDA will do that work at its own expense.

Q. Then that one hundred thousand dollars should not have been there? A. No, because APDA is not going to test and adjust the whole plant, Mr. Sigal.

Q. This is only for preoperational testing, not the whole plant? A. That is right.

Q. How do you distinguish between the areas in which



APDA and PRDC will operate with respect to preoperational testing? A. APDA will operate the test components as to which we have testified in this proceeding previously; the reactor vessel proper; the sodium loop and the nuclear portion of the plant.

Q. What else is there in preoperational testing besides that? A. The rest of the plant?

Q. You mean testing whether or not the concrete work is solid? A. Oh, no.

Q. What do you mean by preoperational testing other than what you have already testified to?

[3522]

A. There are boilers, there are heat exchangers, there are pumps, there are many other portions of the plant that APDA is not actually responsible for.

Q. In your concept, preoperational testing includes testing the ordinary boilers in the building? A. My preoperational testing would be testing the whole plant.

Q. The whole plant? A. Yes, sir.

Q. Regardless of whether or not they are directly related to the reactor, or not? A. That is right.

APDA estimates that it will expend during the test operation for test operations specifically about \$725 thousand.

Some portions of that, and I do not know the figure, would obviously be for plant adjustments in this category of expense items.

Q. That particular breakdown you have mentioned does not appear anywhere in the record as you have now, does it, Mr. Acker? A. The \$725 thousand that I spoke of?

Q. How much will be allocated to APDA expenses for plant equipment adjustments? A. No, that figure is not broken down in the record, Mr. Sigal.

[3523]

Q. Or how much PRDC will do? A. The PRDC figure is one hundred thousand dollars, estimated.

Q. All right.

Now, is the PRDC figure of \$350 thousand—what are you looking at, Mr. Acker, for your figure of four hundred thousand dollars? A. One hundred thousand dollars.

Q. I thought you said four hundred thousand dollars?

A. One hundred thousand dollars.

Q. All right.

The estimate for preoperational testing, \$350 thousand.

A. You are talking about the overall figure?

Q. Yes. A. Yes, by PRDC.

Q. Now, is that all for testing other equipment than the nuclear equipment in the building? A. For testing other equipment than that which will be tested adjusted and so forth by APDA.

Q. And APDA will test and adjust all the nuclear equipment in the building? A. Substantially, yes.

Q. Everything in effect which is within the reactor vessel? A. No, now I cannot say, Mr. Sigal, as to just where

[3524]

this dividing line is. I am not prepared to state that.

What I am stating is that APDA will do a substantial amount of the plant equipment adjustment.

Q. Now, Mr. Acker, has PRDC prepared and submitted to AEC any sketches or designs in addition to what is now in the record of this case, with respect to the reactor building or its parts? A. Not to my knowledge.

Q. Well, now, is it your opinion that on the basis of the

materials now in the record it is possible to arrive at a reasonable estimate of the cost of this reactor?

By materials in the record, I mean the sketches and designs and any other information which PRDC has made available. A. You mean by some outside individual?

Q. Yes, say the AEC's own staff, could they make a reasonably precise estimate on the basis of the information that PRDC has supplied? A. That is a difficult question, Mr. Sigal. I just don't know, frankly, but I would think that with the information which is available in the record and by discussion with PRDC people, that they could make a reasonable evaluation of the estimated cost of this project.

Q. Well, Mr. Acker, I call your attention to the testimony of Mr. Radley on page 3325 of the record. A. Is this in his direct testimony or in the cross

[3525]

examination?

Q. In the cross examination. It is in the transcript.

A. What was the page number, Mr. Sigal?

Q. 3325. A. I have it.

Q. You will note that after I questioned Mr. Radley with respect to why he couldn't give a precise estimate that he stated:

"The sketches in APDA 115 are not adequate for one thing to show the size of the buildings. They are not described very completely. Therefore not very many connections any place. There are a great many uncertainties as to what is required in the project. There is a general lack of information throughout." What is your comment on that, Mr. Acker?

A. With respect to my previous answer, my comment previously was that I thought that there was enough information available in the record and by discussion with the PRDC people for an outside consultant, but I think it would be very essential to have a discussion with the PRDC people.

Q. Do you mean that they have information which you can't put down on paper? A. I think that that is entirely possible.

Q. You mean that they go out and build buildings without fixing dimensions of the buildings?

[3526]

A. I don't mean that, Mr. Sigal.

Q. Mr. Radley says there are not even dimensions of these buildings. You can't tell how big they are going to be. How can you estimate the cost if you don't know the size of the building? A. I think the dimensions could be made readily available.

Q. Why haven't they been made available? You tell us what this is going to cost and give us estimates more or less detailed. How is anyone outside to determine whether or not your estimates have any validity at all if you don't give dimensions or sufficient information to provide a check on your own statements? A. We have no objection whatsoever to giving dimensions, Mr. Sigal.

Q. Why hasn't it been done, Mr. Acker? A. Because it did not appear to be essential for this proceeding.

Mr. Claytor: It seems to me that the question is asking why PRDC has not introduced certain exhibits. I think you might address the question to counsel.

Mr. Sigal: It is a question of man who has com-

mand of all the necessary information. He said he does.

The Presiding Officer: Did he not just answer the question?

[3527]

Mr. Sigal: I am sorry.

The Presiding Officer: Didn't you just answer your question?

— Would you read the answer?

(Thereupon, the pending answer, as heretofore recorded, was read by the reporter:)

By Mr. Sigal:

Q. You mean that PRDC decided, that it was not essential to put into the record for this case sufficient detail about its buildings that an impartial estimate could be made about the costs of that building? A. Mr. Sigal, there is no precedent for this proceeding as far as I know. As far as I know also there are no rules and regulations as to the amounts of detail that must be presented in submitting construction estimates to the AEC.

We have done the best that we could and have stood willing at all times to make a complete revelation of any information that anybody wanted to have and, if dimensions in some instances were omitted, it was not done with any idea of not making the information available, but just as a practical matter in submitting a great mass of detail in this proceeding.

Q. Well, there is no point perhaps in pursuing this any further, Mr. Acker, but it is obvious from the exhibits that you, yourself, have introduced here today that there

is a great amount of what might be considered even trivial detail

[3528]

which has been put into this record which you thought necessary, but apparently even though Mr. Radley pointed out to you many weeks ago that basic information was lacking with respect to the design of the building and other things necessary in order to check your estimates, PRDC hasn't thought it desirable or necessary or convenient to put any more information about those matters into the record; is that correct? A. It seems to me that the record will have to stand for itself. PRDC has not done that. That is true.

Q. What? A. That is true. PRDC has not put additional information into the record.

[3536]

Q. Now, Mr. Acker, you have testified this morning about the amount of cash which may be available to the company at the start of the operations and you referred not only to the amount shown on your auditor's reports but also to an additional

[3537]

amount of approximately \$1,100,000, which, as I understand it, represents the difference between \$4,100,000 at which the component test facility is included in the construction cost estimate and the \$3 million shown as a contribution by APDA, a contribution in kind by APDA. If this is in fact to be an additional amount of cash available

to the company, can you tell us why it does not so appear on the auditor's statements which you have filed? A. I suppose, Mr. Morrisson, because it is indicated as an expenditure. It is an expenditure, however, which in fact will not be made and therefore will represent free cash. I think it very well could have been shown in that way on the auditor's statement. This is sort of a traditional situation in which APDA and PRDC originally evaluated the APDA contribution for the test components at \$3 million. That figure was determined before APDA had made a complete estimate as to what the cost of these facilities might be and the fact is that the \$3 million figure of evaluation of those facilities in our financial statements were carried forward and the estimated cost was put in at a higher figure, although it is in effect a sort of hidden reserve. We could very well have put the \$3 million figure at \$4,100,000, in which event it would have shown up as additional free cash in the statement.

Q. Well, is this because the assumptions which were given to the auditors would not reflect the true situation, or did the

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auditor make some independent determination that in his judgment this amount did not constitute cash available to the company? A. I think this is a situation, Mr. Morrisson, that we simply did not realize the effect of when we instructed the auditor in this way.

Q. When you instructed the auditor, you instructed the auditor how to handle this \$4,100,000 item and the \$3 million item. A. That is right.

Q. I see. What I was concerned about— A. And



something that the auditor did not see through and something that we ourselves did not get onto until we got into this proceeding.

Q. My reason for inquiring into it is that the Commission should naturally feel entitled to rely on the auditor's reports that you have submitted as showing the true cash position. You have stated that your true cash position is more favorable than is shown on the auditor's report. A. That is right.

Q. I was trying to get a clarification on the record as to why this is the case and I am still not entirely clear. Is it that you disagree with the auditor's treatment of this item? A. Now, we couldn't do that very well because we instructed

[3539]

the auditor as to what assumptions to make. We gave the auditor a construction estimate which did not indicate this difference between the estimated costs of these facilities and the evaluation we put on them. We gave the auditor a receipt item to take into account of \$3 million from APDA and I wouldn't think that the auditor saw the effect of this because the auditor did not know specifically, did not specifically have in mind the \$4,100,000 item.

Q. So that what you are saying is that you gave the auditor a construction estimate which included this facility in at \$4,100,000. A. That is right.

Q. And you gave him a receipt item of \$3 million. A. That is right.

Q. And based on those assumptions, he came up with the cash position. A. Right; and in all fairness, I think I should say that I don't think the auditor had the rela-

tionship between the \$3 million figure and the \$4,100,000 called to his attention. He did not have it in mind.

[3542]

Q. I would like to ask you, Mr. Acker, whether there has been any change in the prices for the items shown on Acker Exhibit 20 other than those procured by PRDC which have been

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carried forward into your new exhibit. A. Yes, there have, Mr. Morrisson, and I can give you the changes by items.

Q. All right. Do you have this written out on paper?

Mr. Claytor: No.

By Mr. Morrisson:

Q. You can read it into the record. A. As to item B-3 in the construction estimate, which is the hold-down plate and actuator, the order amount shown in Acker Exhibit 20 was \$145,000 and the order amount in effect June 30, 1957, was \$145,000.

Q. So there is no change. A. There is no change. Item C-1, the primary shield tank showed previously at \$106,350 and as of June 30 at \$120,020, an increase of \$13,670. Item C-3, the index system and drives showed originally at \$60,000, and now at \$57,000, a decrease of \$3,000.

Q. You skipped, I believe C-2 and C-3. A. I am coming back to that. C-4, two control rods, the original figure was \$35,000, the present figure, \$55,678, an increase of

\$20,678. Item C-5, two control rod actuators, originally at \$51,200, still at the same figure, showing no change. Item C-8, the offset element handling mechanism, the original figure was \$190,500, the present figure \$211,400, an increase of \$20,900. Item D-1, one sodium pump, the original

[3544]

figure was \$143,594, the present figure \$175,981, an increase of \$32,387. Item D-1, one check valve, the original figure \$7,700, present figure \$7,678, a reduction of \$22. Item D-5, one sodium piping loop, the original figure was in at \$55,628.

Q. That is not the figure I have here; A. But that was a typographical error and the figure in the APDA records is actually \$59,628.

Q. My figure is \$59,628.

Mr. Claytor: \$59,628 in Acker 29 is the correct figure.

The Witness: The present figure is the same, so there is no change. Item D-6, six flow bracket flow valves, the original figure \$14,635 and the present figure \$14,865, an increase of \$230. These items add up to a total in Acker Exhibit No. 20 of \$813,597. As the amounts of the orders stood on June 30, the amount is \$897,832 an increase in the order amount of \$84,873. I would like to point out that the order amounts as of June 30, aggregating \$897,000, compare with the estimate including contingencies in Acker Exhibit No. 7 of \$973,908.

Now, the other large item included on Acker Exhibit No. 20 is the items C-2 and C-3, the reactor

vessel and rotating plug at a figure of \$1,262,152. The amount of that order as of June 30 is indeterminate. It was at that time undetermined, and is as yet undetermined. The cost of the reactor vessel to the manufacturer, Combustion Engineering, has materially exceeded, I understand, the figure covered by their proposal and APDA's

[3545]

order. The excess or increase in cost has come about by reason of changes in design, additions to the vessel, the necessity of a materially increased amount of engineering, stress analysis and research in connection with metallurgy and so forth. To the extent that the increased cost has come about by reason of changes in design, additions and so forth, APDA now has under negotiations with Combustion Engineering an increase in the order amount.

This matter is in negotiation and I have no specific knowledge as to what the resultant increase will be. I would think it would be somewhere in the neighborhood of 30 percent or something in excess of that but I have no definitive figure because the negotiations have not been completed.

Q. That is an item which is expected to be delivered in the middle of January, next January, is that right?

A. That is right.

Q. You expect that the negotiations will have been completed by that time? A. Oh, I am very certain of that.

Q. That covers, I think, all of the items on Acker

No. 20 which were APDA items. I believe the PRDC items are already included in this other exhibit, are they not?

A. That is right.

[3557]

Q. This was the point I wished to clarify. I have two more questions, Mr. Acker. Can you give me a total for the amount which has been committed or expended by PRDC for research and development? A. Yes, the figure is \$425,125.

Q. Committed? A. Committed, that is right, committed or expended.

Q. Committed or expended; and how much of that has been expended? A. \$97,910. That is as of May 31, 1957.

Q. So that, as of that date the \$5 million budgeted for this purpose had had somewhat less than half a million dollars committed? A. That is right.

Q. Now, Mr. Acker, one of the issues of financial qualification in this case is the qualification of PRDC to repay any Commission charges for special nuclear materials including, of course, the loss of those materials. First, are you in a position to give any estimates as to what the charges for loss of special nuclear materials might be or is this a

[3558]

matter which it would be better to ask of Mr. McCarthy? A. I think Mr. McCarthy could testify in more detail, but in general, as we see it, the exposure is not the loss of a whole core at an estimated figure, say, of \$7 million, but

of some portion of that which might be more in the nature of a million dollars.

Q. Just to correct the record, is not the whole core valued at almost \$8 million, \$7,900,000 or something of that sort? A. I haven't a definitive figure. It is of that nature, \$7 million or \$8 million, whatever it may be. Obviously, we would expect that such potential loss could be covered by insurance through the private companies. In the event that that were not possible, of course, all of the unencumbered assets of PRDC would be available to meet such loss and, if the insurance question isn't resolved and some further protection of the government were required, then we would have to consider some form of guarantee by our member companies to the government.

Q. Have you been advised whether PRDC would have an insurable interest in the core? A. Not as yet.

Q. In view of the fact that the special nuclear material is owned by the government? A. We have not been advised on that as yet, Mr. Morrisson.

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[3570]

KENNETH E. FIELDS was recalled as a witness, and, having been previously duly sworn, was examined and testified further as follows:

*Cross Examination—Resumed by Mr. Sigal*

Q. Mr. Fields, on November 18, 1956, the Atomic Energy Commission issued an announcement that it had established guaranteed fair prices to be paid for plutonium and uranium-233 produced in atomic reactors operated under license in the United.

[3571]

States and delivered to the Commission for the one-year period beginning July 1, 1962. You are aware of that announcement, are you not? A. Yes.

Q. That announcement stated with respect to the prices that for plutonium metal, the price would be \$12 per gram; for uranium-233 nitrate, \$15 per gram, of U-233.

It further stated, and I quote:

"These prices are based on the estimated fuel value of the materials and are identical with those to be paid for these products at reactors abroad fueled with material supplied by the United States."

You are aware of that statement? A. Yes. That is my recollection of it, without looking at it.

Mr. Morrisson: I am showing the witness the text of the press release to which Mr. Sigal is referring.

The Witness: That is my recollection of it without looking at it in detail. If you wish me to verify it exactly, I suppose I can.

By Mr. Sigal:

Q. It would appear from that statement that the price of plutonium was based entirely on its estimated fuel value. Is that a correct conclusion, Mr. Fields? A. I don't believe it is a correct conclusion. That

[3572]

particular price was based on an estimated fuel value for plutonium. I don't believe the announcement excludes other prices for plutonium. At least, that is my recollection of it. I am not sure I understand your point.



Q. No. I said so far as this \$12 guaranteed price for plutonium, that was based, was it not, on the estimated fuel value of plutonium? A. Yes, that was our basis at arriving at \$12. It was an estimate of what its fuel value possibly could be in relation to uranium-235 costs.

Q. Then you say this was done in relation to the uranium-235 cost? A. That is correct. Actually, we have no experience on which to base what is an established value of plutonium in a reactor, in a power producing reactor.

Q. So when you say it is related to the U-235 cost, then what that means, if I understand you, is that you estimated the fuel value of plutonium to be related to the fuel value of uranium-235 as 12 is related to the price of uranium-235?

A. As 12 is related to the price schedule, the so-called \$16 price schedule, of uranium-235, not necessarily the fuel value of uranium-235. We are getting into something—Maybe that is the value of uranium-235 in a reactor over the long run and maybe it is not, as a fuel. That actually

[3573]

happens to be what we charge for uranium-235. If I can follow this just a second, the actual value that works out for uranium-235 in the years ahead may be different than the \$16. It may be more valuable in reactors than \$16. We are charging for it on the basis of full cost recovery.

Q. You are charging for uranium on the basis of full cost recovery? A. That is correct.

Q. You are? A. Yes, that is correct.

Q. And the prices of uranium which revolve around the \$16 per gram figure, represent the cost of recovery?

A. Yes, the cost of production.

Q. The cost of production? A. Yes.

Q. And inasmuch as you did not know the actual cost of production of plutonium, you estimated the price of plutonium by relating the estimated fuel value of plutonium to the non-fuel value of uranium; is that correct? A. To the known charge we make for uranium, yes. Actually, let me be sure the record shows that we do know what it costs us to produce plutonium.

Q. I see. A. Otherwise, that would stand.

Q. And was this price of \$12 per gram for plutonium

[3574]

established in the light of your knowledge of the cost of producing plutonium in your own facilities? A. Well, we know the cost of producing uranium in our own facilities. The 12 was set without using that as a basis for the establishment of the \$12 price.

Mr. Clayton: No. Plutonium.

The Witness: Plutonium. I am sorry.

By Mr. Sigal:

Q. Now, will you start over again? A. I will start over again.

The \$12 price was set based on a calculation, an estimate, as to what plutonium would be worth compared to uranium-235 in a power producing reactor. It was set without regard to the actual cost to us of producing plutonium in our own plants.

Q. In your own plant? A. That is right. I say without regard. Of course, we know what our costs of producing plutonium are.

Q. You do not know what the cost of producing plutonium might be in a commercial reactor, do you? A.

There are no current operating reactors; that is true. You could estimate costs of producing plutonium, but then you have to make assumptions as to how much the power is worth and how much revenue you get from other parts of the plant before you could arrive at what the plutonium would be

[3575]

worth that you produced from that.

No, I would say that at this moment—Well, I would not know how to establish what its true fuel value will be ten years from now, plutonium.

Q. It is also true that you cannot determine the price of plutonium to be produced in a particular reactor without knowing, of course, the characteristics of the particular reactor? A. That is true.

Q. And would not the cost of producing plutonium vary, depending on the size and the power of the reactor? A. I would think so; yes.

Q. So that in one reactor, the cost of plutonium may be much greater than in another reactor? A. The cost of what?

Q. Of producing the plutonium might be much greater. A. Yes, I would think so. I would think so.

Q. Do you have any idea of the area of difference in the cost of producing plutonium? A. That would be so speculative. Some reactors aren't built to produce plutonium, yet produce a little bit.

I mean, they are not designed for the production of plutonium. They are not dual-purpose in that respect.

So the range of what it would cost to produce plutonium in any particular reactor will vary, depending on your

[3576]

in any particular reactor will vary, depending on your assumptions and on the type of the reactor.

I would submit that that is not, alone, the criteria, though, on which one determines the value of a product.

Q. We are now talking about the cost of production?

A. Right.

Q. On May 18, 1957, exactly six months after the announcement we have just been talking about, AEC announced new guaranteed prices for plutonium, is that correct? A. I believe that was the date, yes. That is my recollection.

Mr. Morrisson: That is the date.

By Mr. Sigal:

Q. The second paragraph of this announcement—

Mr. Morrisson: Excuse me a moment. Let me hand the witness a copy of the announcement.

(A document was handed to the witness.)

By Mr. Sigal:

Q. The second paragraph of this announcement reads as follows:

“For purchases between now and July 1, 1962, the price will range from \$30 to \$45 per gram, depending on the plutonium-240 content of the material. For the year July 1, 1962 to June 30, 1963, a single price of \$30 per gram will be in effect. These prices supersede all

[3577]

previous guaranteed fair prices for this material and details of the new schedule will be published in the Federal Register.”

This announcement does not specify, as did the previous announcement, that the price was based on the estimated fuel value, is that correct? A. It does not specify; that is correct.

Q. It does say in the fourth paragraph of that announcement, as follows:

"In making such extension, the Commission expects that the guaranteed fair price for plutonium will be reduced as dictated by consideration of the value of the material for its intended use by the United States and giving such weight to the actual cost of producing it as the Commission finds to be equitable, to a level based upon the fuel value of the plutonium in commercial power reactors."

That statement of criteria is taken from Section 56 of the Atomic Energy Act, is it not, Mr. Fields, which sets forth the criteria for establishing prices? A. I presume that is correct; yes. There is a section, though I have forgotten the number.

(A document was handed to the witness.)

The Witness: Section 56; yes. That is correct.

[3578]

By Mr. Sigal:

Q. Of course, that section was in effect before November 18, 1956? A. That is true.

Q. And presumably, then, the Commission used the same criteria when it determined the prices that it announced on November 18, 1956, did it not? A. The same criteria were in existence; yes.

Q. All right.

Now, inasmuch as the earlier announcement mentioned

only fuel value or estimated fuel value as the determining criteria, and the later announcement mentioned these various considerations other than fuel value, is it correct to say that there will be beginning as of July 1, 1962, two sets of guaranteed prices for plutonium, one of \$12 per gram if the plutonium is to be used for fuel and one of \$30 per gram if the plutonium is to be used for other purposes? A. That comes close to being the assumption with the exception of your latter point on \$30.

Q. Would you explain that? A. I will explain it this way: The prices announced for plutonium, the \$30 price, will apply to licensed power and research reactors in the United States. It is without regard to the fuel value in the United States.

You see, in the United States, by law, the title

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rests with the United States Government. It is contemplated in this period, between now and 1963, that the material we now obtain will be utilized for certain purposes, and the value for those purposes, as we determined on this May 18 price that would be established, that would be paid, the purchase price would be \$30. We set that price by a determination related to its intended use.

Q. Yes, that is what the announcement says. A. Any plutonium that we purchase in the United States between now and then will have a value of \$30 or between now and 1962, it may be, depending on the specifications, that you might pay more, up to \$45, approximately, per gram.

Q. That is set forth in the statement in the Federal Register. A. Actually, the schedule set back in November was to set a price that we would purchase plutonium for

from the reactors that would be built in foreign countries, and as a part of cooperation agreements for purchase by us of plutonium. We had to set a price. We set at the same time a policy that any plutonium produced in foreign reactors would be devoted solely for peaceful purposes.

Consequently, we then had to determine a fuel grade price, in effect, for plutonium, which we determined to be \$12, at that time.

Q. Let me get you straight there. Are you saying

[3580]

now that as of July 1, 1962, there will be two prices in effect? A. After that point, for that year.

Q. For the year beginning July 1, 1962? A. Yes, there will be two.

Q. There will be two prices in effect for plutonium? There will be \$12 per gram if the plutonium is produced in a foreign reactor, and it will be \$30 per gram if the plutonium is produced in a domestic reactor? A. That is correct.

Q. Is that correct? A. That is correct. I would only make sure the record would show that prior to that time there weren't two prices; there were an infinite number of prices depending on the characteristics of the material. Almost an infinite number, though not quite.

Q. Yes. Well, the prices that you mentioned are those that are now set forth in the notice in the Federal Register of June 6, 1957; is that right? A. Is that the right date?

Mr. Morrisson: That is the right date.

The Witness: That is it.

By Mr. Sigal:

Q. Now getting back to the situation as of July 1, 1962,



you say that inasmuch as the assumption is that all plutonium

[3581]

which the AEC will buy from foreign reactors will be used for peaceful purposes, therefore the price will be \$12 because that is the estimated fuel value, but the plutonium produced in domestic reactors will be paid for at \$30 because it will be used for other than peaceful purposes, is that correct? A. That is—Well, I would like not to refer to it quite that way. Because its intended use is different. It could be for purposes—for whatever purposes the Commission uses plutonium for.

Q. Whatever purposes other than the peaceful purposes to which foreign produced plutonium would be put?

A. That is correct.

Q. Of course, the plutonium produced in foreign commercial reactors would be brought over to the United States, is that correct; for processing? A. Either that, or processed in facilities with which we agree, mutually, with the country, as to where it would be reprocessed.

Mr. Morrisson: Mr. Examiner, I have not interposed any objections so far to this line of questioning, because I wanted to see where it was leading. But it seems to me that what Mr. Sigal is trying to do here is to inquire into the reasoning for or the basis for, prices which the Commission has set. I certainly agree that he is entitled to address any questions that he wishes to address to the

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question of what action the Commission has taken and what that action means.

But this is certainly not a legislative inquiry into the justification for the action which the Commission has taken.

I agree, there is no question pending, so I am not making objection now, but I will be compelled to object to further questions which seek to go into the basis for action which the Commission has taken and published in the Federal Register.

Mr. Sigal: Just in general, so there will be no doubt about our purposes, we are not making any investigation as to the basis, the general basis, for the establishment of prices here. We are concerned here about the price that is to be paid to PRDC, and the probability of the continuation of that price during the period the PRDC reactor is operating. We have to go into this matter, into that subject, which, of course, is a basic one in this proceeding.

By Mr. Sigal:

Q. I would like to call your attention, Mr. Fields, to the statement in your testimony before the Joint Committee on Atomic Energy, of the Congress, on or about June 13, 1957. This appears at page 238 of the transcript.

Mr. Morrisson: What hearings are these, Mr. Sigal?

Mr. Sigal: On the Authorization legislation.

[3583]

(A document was handed to the witness.)

By Mr. Sigal:

Q. In response to a question from Representative Hollifield, at the top of that page, you stated:

"During that year, 1963, that one year period from July 1, 1962"—

A. What page are you on?

Q. 238. A. I see it.

Q. I will start over again.

"During that year, 1963, that one year period from July 1, 1962 to 1963, there are only two prices: a \$12 price if its intended use is for peaceful purposes, and a \$30 price. There are no other prices for plutonium."

Mr. Fields, you make no distinction in this statement, and, so far as I can tell, you don't make that distinction in any part of your testimony, that the \$12 per gram is to be limited to plutonium produced in foreign reactors, if that plutonium is intended for peaceful purposes. A. I can't answer the question. We have had a number of hearings with the Joint Committee. This point did come up. I am not sure it did come up in these open hearings or in executive hearings before the Committee. We have gone over this subject of prices fully with the Joint Committee. I am not quite sure—Well, excuse me, I am not quite sure.

[3584]

I certainly have recognized all along that what we were talking about was the foreign prices here. I don't know what would happen if someone in this country would say that their plutonium should be for peaceful purposes. We have not had the situation arise.

Q. I am sorry, I didn't get your last remark. A. I am sorry I don't recall that we did discuss this particular aspect of this question in open hearings. It has been discussed, I am quite confident, with the Committee.

Q. From this statement, it would appear, would it not, Mr. Fields, that the plutonium for which you pay \$30 will not be used for peaceful purposes? A. I believe that is a—Well, let's just see here. I would have to read the statement a lot more carefully than just right now in order to say "yes" on that. You would ordinarily conclude that that is what was going to happen. But what I should say is this, that the price we have established in this country is for its intended use. It happens to be \$30 or higher between now and July 1 of 1962. It is not a foregone conclusion that every bit of that plutonium will end up in a military use, because we are using plutonium for other uses. But we are establishing a price on the intended use of our overall plutonium during this period. We may put plutonium in a power-producing reactor ourselves and we may not have gotten any from abroad during this period. It

[3585]

will be the same plutonium.

Q. Whether you get it from abroad or whether you get it locally, it will be the same plutonium? A. It will be the same material; yes.

Q. Of course, the price you are establishing is for just the one year, the price we have been talking about; that is, is the price just the one year, July 1, 1962 to June 30, 1963? A. Which price are you talking about?

Q. The \$12 price and the \$30 price. A. No, the \$12 price applies from now through July 1, 1963, to any plutonium purchased from abroad.

Q. From abroad? A. Yes.

Q. I see. The \$30 price applies— A. From now until July 1 of 1963 for certain grades of plutonium.

Q. For certain grades? A. In the period from now until July 1, 1962, it is \$30 or higher depending on the characteristics of the plutonium and then for that extra year it is \$30.

Q. \$30 for all plutonium produced in domestic reactors? A. Yes.

Q. And regardless of quality? A. Regardless of characteristics.

[3603]

By Mr. Sigal:

Q. Has AEC made it clear to PRDC that it cannot expect any specific price for plutonium after June 30, 1963? A. I believe I could say yes to that, that it is clear that we have not indicated to anyone—we can't, obviously, until we announce a new guaranteed price—what it will be.

Mr. Claytor: The record contains the statement, Mr. Examiner, on page six of Acker's supplemental testimony, that PRDC has no information or assurance as to what such price will be after June 30, 1963. There is no issue on that.

Mr. Sigal: Mr. Examiner, are we arguing the case now, or may I continue with my examination of Mr. Fields?

The Presiding Officer: You may continue.

By Mr. Sigal:

Q. Mr. Fields, simply in corroboration of your own statement here, I would like to quote the statement you made to the joint committee in the authorization hearings,

[3604]

beginning at page 235, the bottom of the page, where you said, "We have no authority to guarantee prices beyond the time of seven years. Our presently announced schedule goes to July 1, 1963. It has been made very clear to all concerned, including the Power Reactor Development Company, that what happens after that is such to future determination." A. That is correct.

. . .

[3614]

Q. That is perfectly clear, Mr. Fields.  
Going back for a moment to the matter of

[3615]

the announcement of May 18, 1957, do you have the release before you? A. I have the public release, yes. I don't have the Federal Register publication.

Q. Well, I mean that release that you have there. It states at the bottom of the page that the Commission expects that the guaranteed fair price for plutonium will be reduced as dictated by consideration of the value of the material for its intended use by the United States, and giving such weight to the actual cost of producing it as the Commission finds to be equitable to a level based upon the fuel value of plutonium in commercial power reactors.

It would appear from this that even with respect to this announcement, this latest price schedule, that the objective is ultimately, according to the official position of AEC, to reduce the price for plutonium to a level based upon its

fuel value in commercial power reactors. Is that correct?

A. I believe that is correct, yes.

Q. One thing with respect to this, however, that is not clear, is just when you will reduce it. A. That is correct.

Q. And this reduction may take place at any time after June 30, 1963? Is that correct? A. I would say at any time that the factors that

[3616]

dictate the determination of the fair price change, I presume the guarantee will change, yes.

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*Cross Examination by Mr. Claytor*

[3621]

By Mr. Claytor:

Q. General Fields, your estimate of the \$12 fuel value of plutonium was based on a calculation of its use as a fuel in a thermal type of reactor, wasn't it? A. Yes, this is correct. The relative value of plutonium and Uranium-235 in a thermal reactor.

Q. And it might have a higher fuel value if used as a fuel in a fast reactor, might it not? A. I am not that technical an expert, but that is my understanding from a reactor physics point of view, that it could have a higher value, relative value, to Uranium-235.

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WALTER J. McCARTHY, JR. (recalled).

[3870]

*Direct Examination by Mr. Claytor*

Q. Have you made any calculations to determine the relative worth of Uranium 235 and Plutonium 239 in a fast reactor?

Mr. Sigal: I object to that question.

Relative worth in what respect?

Now, if the question seeks a price, it is my impression that the witness is not qualified.

Mr. Claytor: Relative worth as a fuel. I thought the question indicated that. We are not asking about money. We are asking about fuel.

The Presiding Officer: He may not testify as to dollars. He may testify as to relative value, but not dollars.

Mr. Morrisson: The question seeks a physical quality. Is that right?

Mr. Claytor: Yes, the question seeks a physical quality.

The Witness: Yes. In a fast reactor of the size and neutron spectrum which is typified by the PRDC reactor in particular, the value of alpha for plutonium is such that the worth of plutonium, just as a sheer B. t. u. worth per gram put in, is about 60 percent higher than that of Uranium 235. This takes into account the decrease of the number of atoms in a gram. Obviously 235—239—This is as many atoms of plutonium in a gram as there are 235,

[3871]

and this is taken into account.

By Mr. Claytor:

Q. Since nuclear fuels are potential sources of heat, Mr. McCarthy, as are coal and other materials, is it possible to compare nuclear fuels, as used in a fast reactor, to such conventional fuels as coal based on an assumed value per heat unit of the conventional fuels?

My question asks is it possible to do this.

Mr. Sigal: I am sorry. That question escaped me. Will you please repeat it.

Mr. Claytor: Would you read my question, Mr. Reporter.

(The pending question was read by the reporter.)

Mr. Sigal: I still have to say I do not understand the question. If the witness understands it, I assume he will answer it.

The Witness: Yes, the witness understands it, Mr. Sigal. The question essentially means, since a gram of a fissionable fuel can be fissioned and make a certain amount of heat from that fission, and since a pound, say, of coal can be burned and can make a certain amount of heat from that pound of coal, how can you compare these on a dollar-per-B. t. u. basis. And you do this essentially by figuring out how many B. t. u. you get from a gram of plutonium or uranium should it fission. You can then, if you assume a

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price for B. t. u. and lots of B. t. u. are sold every day, and we know what they cost; then you can make

a ratio and find out how much the nuclear fuel is worth compared to the conventional fuel.

Now in an area such as Detroit coal in particular costs about 30 cents for every million B. t. u. of it you buy. That is the going price around there. This doesn't vary appreciably throughout the country. But in Detroit it is about 30 cents per million B. t. u.

Since a gram of plutonium, if burned in a fast reactor, makes about 65 million B.t.u., you can multiply the cents per million of the coal by the amount of millions you get in a reactor, and you come out with an equivalent cost, and this comes out to be about \$21 per gram for plutonium as compared to coal as a heat source only. In other words, I could afford to pay \$21 for plutonium in an area where coal costs 30 cents per million B.t.u. to get the same amount of physical heat.

By Mr. Chaytor:

Q. Does that calculation assume that plutonium is being used as a fuel in a fast reactor, a thermal reactor? Or does it make a difference? A. It does make a difference. This particular calculation assumes it is made in a fast reactor. If it is made in a thermal reactor, a number of things happen. The

[3873]

principal one is this value alpha, the efficiency of burning, goes way down for plutonium in a thermal reactor. In particular Plutonium 239 captures neutrons without causing fission about one out of every three times. So this value alpha is .5 in this case.

The portions of the written narrative testimony, pages 3920-4401, designated by the parties are contained in Volume III of this joint appendix.

[4409]

**Exhibit Acker 1-A****(PRDC-AEC REPROCESSING AGREEMENT)****UNITED STATES  
ATOMIC ENERGY COMMISSION****CHICAGO OPERATIONS OFFICE****P. O. Box 59  
Lemont, Illinois****March 25, 1957**

**Mr. Walker L. Cisler, President  
Power Reactor Development Company  
1100 Dime Building  
Detroit 26, Michigan**

**Dear Mr. Cisler:**

In furtherance of our program to demonstrate the practical value of nuclear power, the Commission and PRDC are ready to execute a contract, (designated as number AT(11-1)-476) under which PRDC will provide and operate an experimental nuclear power plant and the Commission will have conducted certain research and development work for the Project.

Much consideration has been given to the prices and arrangements under which spent fuel and blanket material from the reactor will be reprocessed. The Commission has now established policies in this area, which were published in the Federal Register (22 F.R. 1591) on March 12, 1957. Based upon and subject to the above-mentioned policies, which are incorporated herein by reference, the following charges are established:

### A. *Reprocessing Services*

If requested to do so by the Company, the Commission will accept material for the purpose of furnishing the services specified below:

#### 1. *Core Subassemblies*

- b. The Commission will disassemble as necessary the irradiated core subassemblies.
- b. The Commission will separate and recover uranium and plutonium from irradiated core subassemblies.

[4410]

converting such uranium and plutonium to decontaminated uranium nitrate and plutonium nitrate respectively.

- c. The Commission will dispose of all wastes resulting from the above steps.

#### 2. *Blanket Subassembly Reprocessing*

- a. The Commission will disassemble as necessary the irradiated subassemblies.
- b. The Commission will separate out and recover uranium and plutonium from irradiated blanket subassemblies, converting such uranium and plutonium to decontaminated uranium nitrate and plutonium nitrate respectively.
- c. The Commission will dispose of all wastes resulting from the above steps.

#### 3. *Disposition of Depleted Uranium Nitrate*

The Commission will store depleted uranium nitrate resulting from reprocessing blanket materials or

return the depleted uranium nitrate to the Company, at the Company's option.

4. *Conversion of Enriched Uranium Nitrate to  $UF_6$*

The Commission will convert the enriched uranium nitrate to  $UF_6$ .

5. *Conversion of Plutonium Nitrate to Metal*

The Commission will convert plutonium nitrate to metal.

B. *Schedule of Charges*

1. For the services set forth in subsection A. 1. above, the Company will pay the Commission on the basis of the daily cost of \$15,300.00 and a daily throughput of 150 kilograms of contained uranium.

[4411]

2. For the services to be performed under Subsection A. 2. above, the Company will pay the Commission on the basis of the daily cost of \$15,300.00 and a daily throughput of 1,000 kilograms of contained uranium.
3. For storing depleted uranium nitrate, the Company will pay the Commission the costs of the storage containers.
4. For the services to be performed under Subsection A. 4. above, the Company will pay the Commission an amount established by the Commission but not exceeding \$35.00 per kilogram of contained uranium.
5. For the services to be performed under Subsection A. 5. above, the Company will pay the Commission the charges set forth in Exhibit A to this letter.



6. The charges set forth in B. 1. and 2. above do not include an allowance for "turn around" time at the processing facilities. Therefore, an additional charge to cover this item will be made in accordance with subsection 6. (d) of the policy statement set forth in 22 F. R. 1591.
7. An additional charge to cover process losses will be made at the rate of 1 percent of the value of the government-owned source or special nuclear materials to be processed. Unless waived by the AEC, a use charge on leased source and special nuclear material will also be made to cover the normal processing time after delivery of fuel to the AEC.
8. Persons who have contracted with the AEC for these processing services will be credited with the value of government-owned source and special nuclear material contained in the fuel in accordance with the appropriate AEC price schedules for such materials, less the processing charges as determined in the above manner. The AEC will acquire title, without additional cost, to all waste materials contained in the fuel which were not previously the property of the United States.
9. The above charges are all F. O. B. the Commission plant.

[4412]

*Changes*

It is recognized that these charges are based on information covering the designs of the core and blanket.

subassemblies and the batch sizes returned for processing which was furnished with the letter of June 4, 1956, from R. W. Hartwell to C. G. Manley, and that the designs and batch sizes are subject to change. Any change in the design may affect the flow rates specified in B. 1. and 2. above and may also result in an appropriate change in the daily processing charge for services as set forth in this letter.

It is understood that PRDC and the Commission will, within the next six months, negotiate a formal agreement superseding this letter and covering reprocessing arrangements, such agreement not to be inconsistent with the foregoing Commission policies and to contain prices no higher than those provided in B. In the event such formal agreement is not completed within six months, or such other time as may be mutually agreed upon, either party may terminate this agreement.

In addition, it is understood that any more favorable terms or conditions than those set forth above which are adopted by the Commission in the future for general application and for comparable services will be extended to the company.

If the foregoing is acceptable to PRDC, please so indicate by approving two copies of this letter and return them to me.

Very truly yours,

J. J. FLAHERTY

J. J. FLAHERTY

Manager

Enclosure:

Exhibit A. (Sep. cov.)

4413

Accepted this 26 day of March, 1957

WALKER L. CISLER

Walker L. Cislcr, President

Power Reactor Development Company

[4413]

**Exhibit Acker 1-B**

(EXHIBIT A TO PRDC-AEC REPROCESSING  
AGREEMENT)

[CONFIDENTIAL]

UNCLASSIFIED

EXHIBIT A to LETTER DATED MARCH 25, 1957,  
FROM J. J. FLAHERTY, MANAGER, CHICAGO OP-  
ERATIONS OFFICE, U. S. ATOMIC ENERGY COM-  
MISSION, TO WALKER L. CISLER, PRESIDENT,  
POWER REACTOR DEVELOPMENT COMPANY

For the services to be performed under Subsection A. 5 of  
the above-referenced letter, the Company will pay the Com-  
mission the charge of \$1.50 per gram of contained pluto-  
nium.

J. F.

MC

CLASSIFICATION CANCELLED

Name: rm

Date: 5-10-57

[RESTRICTED DATA]

[This document contains restricted data as defined  
in the Atomic Energy Act of 1954. It is trans-

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mittal or disclosure of its contents in any manner to an unauthorized person is prohibited.]

[CONFIDENTIAL]  
UNCLASSIFIED

[Matter enclosed between brackets cancelled in copy]

[4414]

**Exhibit Acker 2**

(SEE ALSO LATER EXHIBIT, APPLICATION  
EXHIBIT XLIV, Tr. pp. 6070-78.)

**POWER REACTOR DEVELOPMENT COMPANY  
ENRICO FERMI ATOMIC POWER PLANT PROJECT  
STATEMENT OF SOURCE AND APPLICATION OF  
CASH DURING PERIOD OF OPERATIONS**

Arthur Andersen & Co.  
Detroit

February 27, 1957.

[4415]

**POWER REACTOR DEVELOPMENT COMPANY  
ENRICO FERMI ATOMIC POWER PLANT PROJECT  
STATEMENT OF SOURCE AND APPLICATION OF  
CASH DURING PERIOD OF OPERATIONS**

At the request of the Company, statements showing the source and application of cash during the period of prospective operations, which period covers the years 1961

through 1970, were prepared based upon data furnished by Company personnel as of December 31, 1956. The attached statements represent revision of the statements of December 31, 1956, based upon data available as of February 27, 1957.

Power Reactor Development Company has received an opinion from its tax counsel, Mr. Roswell Magill, that it is exempt from Federal income taxation as a nonprofit scientific institution under Section 501 of the Internal Revenue Code of 1954. A request for ruling that it is such a tax-exempt organization is now pending before the Internal Revenue Service. Schedule 1 is a statement of source and application for cash during the period of operations on the assumption that the Company will not be subject to Federal income tax liability during this period.

The Company has considered the possibility that, contrary to the opinion of its tax counsel, favorable action will not be received on its pending request for ruling that it is exempt from Federal income taxation as a nonprofit scientific institution. In the event that the Company's request for ruling that it is exempt from Federal income tax is denied, the Company's tax counsel has prepared and now has pending before the Internal Revenue Service a request for ruling to determine whether or not the contributions of its members are taxable income to the Company.

#### [4416]

Schedule 2, showing source and application of cash during the period of operations, is based on the assumption that there will be Federal income tax liability, but that the contributions from members will not be taxable income.

to the Company. Schedule 3, showing source and application of cash during the period of operations, is based on the assumption that there will be Federal income tax liability and that the contributions from members will be taxable income to the Company.

Cash sources and cash applications for the period of operations are based upon data furnished by Company personnel. Cash balance at the beginning of 1961 is a carry-forward from the statements of source and application of cash during the construction period.

In determining the Federal income tax liability shown on Schedules 2 and 3, the cash sources and cash applications for the period of operations as furnished by Company personnel were adjusted to reflect depreciation expense.

In computing the Federal income tax liability assuming that contributions from members are not taxable income to the Company which appears on Schedule 2, the tax basis of the plant for depreciation purposes is decreased in an amount equal to the contributions. This adjustment represents conservative tax accounting for money contributed to a corporation for plant construction.

Tax counsel for the Company has given an opinion that the cost of the plant (exclusive of the estimated site improvement costs) in excess of the cost of conventional facilities may be considered as research and development expense. The tax basis of the plant for

[4417]

depreciation purposes is adjusted to reflect this treatment in computing the Federal tax liability assuming that con-

contributions from members are taxable income which appears on Schedule 3. Cost of a conventional steam plant of the same capacity is estimated by Company engineers to be approximately \$13,200,000.

The Company engineers furnished the estimated life of the plant and net salvage.



STATEMENT OF SOURCE AND APPLICATION OF CASH  
DURING TEN YEAR OPERATING PERIOD  
ASSUMING THAT COMPANY HAS NO FEDERAL INCOME TAX LIABILITY

Particulars	Line No.	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	Total
Source of cash-												
Operating revenues-												
Steam sales	1	\$ 1,191,000	\$1,537,000	\$3,878,000	\$3,649,000	\$ 4,644,000	\$ 5,332,000	\$ 5,182,000	\$ 5,867,000	\$ 6,015,000	\$ 6,165,000	\$43,466,000
Sales of plutonium	2	1,383,000	1,864,000	3,987,000	4,076,000	5,526,000	6,228,000	6,313,000	6,497,000	6,888,000	6,861,000	48,623,000
Temporary bank loans	3	287,700	1,986,800		1,162,400							3,436,900
	4	\$ 2,861,700	\$5,387,800	\$6,865,000	\$8,887,400	\$10,170,000	\$11,566,000	\$11,495,000	\$12,364,000	\$12,903,000	\$13,026,000	\$95,525,900
Application of cash-												
Operating expenses-												
Production costs	5	\$ 1,472,700	\$1,536,300	\$1,801,900	\$1,831,500	\$ 1,977,200	\$ 2,063,800	\$ 2,052,500	\$ 2,180,200	\$ 2,217,200	\$ 2,257,600	\$19,390,000
Core processing costs	6	778,000	742,000	757,000	849,000	840,000	782,000	725,000	749,000	794,000	795,000	7,811,000
Blanket processing costs	7	235,000	261,000	345,000	431,000	556,000	717,000	713,000	728,000	762,000	761,000	5,509,000
Additional fuel cycle costs	8	1,202,000	1,294,000	1,832,000	2,237,000	3,216,000	3,396,000	3,361,000	3,532,000	3,677,000	3,677,000	27,424,000
Property taxes	9	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	6,900,000
Insurance	10	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	1,490,000
Interest on long-term bank loans	11	652,000	653,000	652,000	587,000	500,000	414,000	326,000	39,000	153,000	33,000	4,209,000
Interest on temporary bank loans	12	7,000	62,500	97,800	112,900	138,800	105,800	40,300	200			565,000
Payment of principal on long-term bank loans	13				2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	3,000,000	15,000,000
Payment of principal on temporary bank loans	14			540,300		103,000	1,248,400	1,438,200	107,000			3,436,900
	15	\$ 5,185,700	\$5,387,800	\$ 6,865,000	\$8,887,400	\$10,170,000	\$11,566,000	\$11,495,000	\$10,374,400	\$10,422,200	\$11,362,600	\$91,736,000
Net cash increase (decrease) during year	16	\$ (2,324,000)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,989,600	\$ 2,460,800	\$ 1,663,400	\$ 3,729,000
Cash balance - beginning of 1961	17	\$ 3,499,000										
Cash balance - end of year	18	\$ 1,175,000	\$1,175,000	\$1,175,000	\$1,175,000	\$ 1,175,000	\$ 1,175,000	\$ 1,175,000	\$ 3,164,600	\$ 5,625,400	\$ 7,288,800	\$ 7,288,800

[4419]

SCHEDULE NO. 4

**STATEMENT OF SOURCE AND APPLICATION OF CASH**  
**DURING TEN YEAR OPERATING PERIOD**  
**ASSUMING THAT COMPANY HAS FEDERAL INCOME TAX LIABILITY**  
**AND THAT CONTRIBUTIONS ARE NOT TAXABLE INCOME**

Particulars	Line No.	Y e a r										Total
		1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	
Source of cash-												
Operating revenues-												
Steam sales	1	\$ 1,191,000	\$1,537,000	\$3,878,000	\$3,649,000	\$ 4,644,000	\$ 5,338,000	\$ 5,182,000	\$ 5,867,000	\$ 6,015,000	\$ 6,165,000	\$43,466,000
Sales of plutonium	2	1,383,000	1,864,000	2,987,000	4,076,000	5,526,000	6,228,000	6,313,000	6,497,000	6,888,000	6,861,000	48,623,000
Temporary bank loans	3	287,700	1,986,800		1,162,400							3,436,900
	4	\$ 2,861,700	\$5,387,800	\$6,865,000	\$8,887,400	\$10,170,000	\$11,566,000	\$11,495,000	\$12,364,000	\$12,903,000	\$13,026,000	\$95,525,900
Application of cash-												
Operating expenses-												
Production costs	5	\$ 1,472,700	\$1,536,300	\$1,601,900	\$1,831,500	\$ 1,977,200	\$ 2,063,800	\$ 2,052,500	\$ 2,180,200	\$ 2,217,200	\$ 2,257,600	\$19,390,900
Core processing costs	6	778,000	742,000	757,000	849,000	840,000	782,000	725,000	749,000	794,000	795,000	7,811,000
Blanket processing costs	7	235,000	261,000	345,000	431,000	556,000	717,000	713,000	728,000	762,000	761,000	5,509,000
Additional fuel cycle costs	8	1,202,000	1,294,000	1,832,000	2,237,000	3,216,000	3,396,000	3,361,000	3,532,000	3,677,000	3,677,000	27,424,000
Property taxes	9	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	6,900,000
Insurance	10	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	1,490,000
Interest on long-term bank loans	11	652,000	653,000	652,000	587,000	500,000	414,000	326,000	239,000	153,000	33,000	4,209,000
Interest on temporary bank loans	12	7,000	62,500	97,800	112,900	138,400	105,800	40,300	200			565,300
Payment of principal on long-term bank loans	13	-	-	-	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	3,000,000	15,000,000
Payment of principal on temporary bank loans	14	-	-	540,300	-	103,000	1,248,400	1,438,200	107,000	-	-	3,436,900
Federal income tax payments (see Schedule No. 4)	15	-	-	-	-	-	-	-	273,600	1,381,600	2,729,400	4,584,600
	16	\$ 5,185,700	\$5,387,800	\$6,865,000	\$8,887,400	\$10,170,000	\$11,566,000	\$11,495,000	\$10,848,000	\$11,823,800	\$14,092,000	\$96,320,700
Net cash increase (decrease) during year	17	\$ (2,324,000)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,516,000	\$ 1,079,200	\$ (1,066,000)	\$ (794,800)
Cash balance - beginning of 1961	18	\$ 3,499,000										
Cash balance - end of year	19	\$ 1,175,000	\$1,175,000	\$1,175,000	\$1,175,000	\$ 1,175,000	\$ 1,175,000	\$ 1,175,000	\$ 2,691,000	\$ 3,770,200	\$ 2,704,200	\$ 2,704,200

[4420]  
STATEMENT OF SOURCE AND APPLICATION OF CASH  
DURING TEN YEAR OPERATING PERIOD  
ASSUMING THAT COMPANY HAS FEDERAL INCOME TAX LIABILITY  
AND THAT CONTRIBUTIONS ARE TAXABLE INCOME

Particulars	Line No.	Y e a r										Total
		1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	
Source of cash-												
Operating revenues-												
Steam sales	1	\$ 1,191,000	\$ 1,537,000	\$ 3,878,000	\$ 3,649,000	\$ 4,644,000	\$ 5,338,000	\$ 5,182,000	\$ 5,867,000	\$ 6,015,000	\$ 6,165,000	\$ 43,466,000
Sales of plutonium	2	1,383,000	1,864,000	2,987,000	4,076,000	5,526,000	6,228,000	6,313,000	6,497,000	6,888,000	6,861,000	48,523,000
Temporary bank loans	3	1,421,600	909,600	-	1,155,400	-	-	-	-	-	-	3,496,600
	4	\$ 3,995,600	\$ 4,310,600	\$ 6,865,000	\$ 8,890,400	\$ 10,170,000	\$ 11,566,000	\$ 11,495,000	\$ 12,364,000	\$ 12,903,000	\$ 13,026,000	\$ 95,585,600
Application of cash-												
Operating expenses-												
Production costs	5	\$ 1,472,700	\$ 1,536,300	\$ 1,801,900	\$ 1,831,500	\$ 1,977,200	\$ 2,063,800	\$ 2,052,500	\$ 2,180,200	\$ 2,217,200	\$ 2,257,600	\$ 19,390,900
Core processing costs	6	778,000	742,000	757,000	849,000	840,000	782,000	725,000	749,000	794,000	795,000	7,811,000
Blanket processing costs	7	235,000	261,000	345,000	431,000	556,000	717,000	713,000	728,000	762,000	761,000	5,509,000
Additional fuel cycle costs	8	1,202,000	1,294,000	1,832,000	2,237,000	3,216,000	3,396,000	3,361,000	3,532,000	3,677,000	3,677,000	27,424,000
Property taxes	9	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	6,900,000
Insurance	10	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	1,490,000
Interest on long-term bank loans	11	652,000	653,000	652,000	587,000	500,000	414,000	326,000	239,000	153,000	33,000	4,209,000
Interest on temporary bank loans	12	34,700	91,500	100,600	115,900	141,900	109,100	43,700	700	-	-	628,100
Payment of principal on long-term bank loans	13	-	-	-	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	3,000,000	15,000,000
Payment of principal on temporary bank loans	14	-	-	537,500	-	99,900	1,245,100	1,434,800	179,300	-	-	3,496,600
Federal income tax payments (refunds) (see Schedule No. 6)	15	603,100	(1,106,200)	-	-	-	-	-	305,200	1,157,600	2,562,600	3,522,300
	16	\$ 5,816,500	\$ 4,310,600	\$ 6,865,000	\$ 8,890,400	\$ 10,170,000	\$ 11,566,000	\$ 11,495,000	\$ 10,752,400	\$ 11,599,800	\$ 13,925,200	\$ 95,390,900
Net cash increase (decrease) during year	17	\$ (1,820,900)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,611,600	\$ 1,303,200	\$ (899,200)	\$ (194,700)
Cash balance - beginning of 1961	18	\$ 2,995,900										
Cash balance - end of year	19	\$ 1,175,000	\$ 1,175,000	\$ 1,175,000	\$ 1,175,000	\$ 1,175,000	\$ 1,175,000	\$ 1,175,000	\$ 2,786,600	\$ 4,089,800	\$ 3,190,600	\$ 3,190,600

CALCULATION OF FEDERAL INCOME TAX PAYMENTS DURING OPERATING PERIOD

ASSUMING THAT CONTRIBUTIONS ARE NOT TAXABLE INCOME

Line No.	Y e a r										Total
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970 (see Note)	
g revenues	\$ 1,191,000	\$ 1,537,000	\$ 1,878,000	\$ 2,649,000	\$ 4,644,000	\$ 5,338,000	\$ 5,182,000	\$ 5,867,000	\$ 6,015,000	\$ 6,165,000	\$23,466,000
	1,383,000	1,854,000	2,987,000	4,076,000	5,526,000	6,228,000	6,313,000	6,497,000	6,888,000	6,861,000	48,623,000
	\$ 2,574,000	\$ 3,401,000	\$ 6,865,000	\$ 7,725,000	\$ 10,170,000	\$ 11,566,000	\$ 11,495,000	\$ 12,364,000	\$ 12,903,000	\$ 13,026,000	\$92,089,000
ts costs	\$ 1,472,700	\$ 4,536,300	\$ 1,801,900	\$ 1,831,500	\$ 1,977,200	\$ 2,063,800	\$ 2,052,500	\$ 2,180,200	\$ 2,217,200	\$ 2,257,600	\$19,390,900
	778,000	742,000	757,000	845,000	840,000	782,000	725,000	749,000	794,000	795,000	7,811,000
	235,000	261,000	345,000	431,000	556,000	717,000	713,000	728,000	762,000	761,000	5,509,000
bank loans bank loans dule No. 5 research and	1,202,000	1,294,000	1,832,000	2,237,000	3,216,000	3,396,000	3,361,000	3,532,000	3,677,000	3,677,000	27,424,000
	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	6,900,000
	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	1,490,000
	652,000	653,000	652,000	587,000	500,000	414,000	326,000	230,000	153,000	31,000	2,209,000
	7,000	62,500	97,800	112,900	138,800	105,800	40,300	200	-	-	565,300
	650,100	650,100	650,100	650,100	650,100	650,100	650,100	650,100	650,100	650,100	6,501,000
	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	5,000,000
	\$ 6,335,800	\$ 6,537,900	\$ 7,474,800	\$ 8,037,500	\$ 9,217,100	\$ 9,467,700	\$ 9,206,900	\$ 9,417,500	\$ 9,592,400	\$ 9,512,700	\$84,800,200
ity	\$ (3,761,800)	\$ (3,126,900)	\$ (609,800)	\$ (312,500)	\$ 952,900	\$ 2,098,300	\$ 2,288,100	\$ 2,946,500	\$ 3,310,700	\$ 3,513,300	\$ 7,288,400
nts	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,047,100	\$ 1,716,100	\$ 1,821,400	\$ 4,584,600
	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 473,600	\$ 1,381,600	\$ 2,729,400	\$ 4,584,600

NOTE: The Federal income tax payment for 1970 includes the entire liability applicable to that year although \$960,700 is not due until 1971.



[4422]

SCHEDULE NO. 5

CALCULATION OF ANNUAL DEPRECIATION  
ASSUMING THAT CONTRIBUTIONS  
ARE NOT TAXABLE INCOME

Plant expenditures (see Exhibit XXVIII, Schedule No. 4, Line No. 1) .....	\$28,225,000
Add—Administration expense (see Exhibit XXVIII, Schedule No. 4, Line No. 4) .....	1,816,000
Total plant .....	<u>\$30,041,000</u>
Less—Contributions (see Exhibit XXVII, Schedule No. 1, Line No. 1) .....	<u>23,540,000</u>
Net depreciable plant—adjusted basis .....	<u>\$ 6,501,000</u>
Annual depreciation—based on ten year life and assuming that salvage will be equal to cost of removal .....	<u>\$ 1,363,890</u>

[4423]

## CALCULATION OF FEDERAL INCOME TAX PAYMENTS DURING OPERATING PERIOD

ASSUMING THAT CONTRIBUTIONS ARE TAXABLE INCOME

Particulars	Line No.	Year										Total
		1961	1962	1963	1964	1965	1966	1967	1968	1969	1970 (Note)	
Operating revenues-												
Steam sales	1	\$ 1,191,000	\$ 1,537,000	\$ 3,878,000	\$ 3,649,000	\$ 4,644,000	\$ 5,338,000	\$ 5,182,000	\$ 5,867,000	\$ 6,015,000	\$ 6,165,000	\$45,240,000
Sales of plutonium	2	1,383,000	1,864,000	2,987,000	4,076,000	5,526,000	6,228,000	6,313,000	6,497,000	6,888,000	6,861,000	48,623,000
Total operating revenues	3	\$ 2,574,000	\$ 3,401,000	\$ 6,865,000	\$ 7,725,000	\$ 10,170,000	\$ 11,566,000	\$ 11,495,000	\$ 12,364,000	\$ 12,903,000	\$ 13,026,000	\$93,863,000
Expenses:												
Production costs	4	\$ 1,472,700	\$ 1,536,300	\$ 1,801,900	\$ 1,831,500	\$ 1,977,200	\$ 2,063,800	\$ 2,052,500	\$ 2,180,200	\$ 2,217,200	\$ 2,257,600	\$19,390,900
Core processing costs	5	778,000	742,000	757,000	849,000	840,000	782,000	725,000	749,000	794,000	795,000	7,812,000
Blanket processing costs	6	235,000	261,000	345,000	431,000	556,000	717,000	713,000	728,000	762,000	761,000	5,502,900
Additional fuel cycle costs	7	1,202,000	1,294,000	1,832,000	2,237,000	3,216,000	3,396,000	3,361,000	3,532,000	3,677,000	3,677,000	27,424,000
Property taxes	8	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000	6,710,000
Insurance	9	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	149,000	1,490,000
Interest on long-term bank loans	10	652,000	653,000	652,000	587,000	500,000	414,000	326,000	239,000	153,000	33,000	4,204,000
Interest on temporary bank loans	11	34,700	91,500	100,600	115,900	141,900	109,100	43,700	700			648,100
Depreciation (see Schedule No. 7)	12	1,363,890	1,363,890	1,363,890	1,363,890	1,363,890	1,363,890	1,363,890	1,363,890	1,363,890	1,363,890	13,638,900
Total expenses	13	\$ 6,577,290	\$ 6,780,690	\$ 7,691,390	\$ 8,254,290	\$ 9,433,990	\$ 9,684,790	\$ 9,424,090	\$ 9,631,790	\$ 9,806,090	\$ 9,726,490	\$87,010,000
Net taxable income (loss)	14	\$ (4,003,290)	\$ (3,379,690)	\$ (26,390)	\$ (529,290)	\$ 736,010	\$ 1,881,210	\$ 2,070,910	\$ 2,732,210	\$ 3,096,910	\$ 3,299,510	\$ 5,078,100
Federal income tax liability	15	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 710,300	\$ 1,604,900	\$ 1,710,200	\$ 4,025,400
Federal income tax payments (refunds)	16	\$ 603,100	\$ (1,106,200)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 305,200	\$ 1,157,600	\$ 2,562,600	\$ 3,522,300

NOTE: The Federal income tax payment for 1970 includes the entire liability applicable to that year although \$905,100 is not due until 1971.

[4424]

## SCHEDULE NO. 7

CALCULATION OF ANNUAL DEPRECIATION  
ASSUMING THAT CONTRIBUTIONS  
ARE NOT TAXABLE INCOME

Plant expenditures—(see Exhibit XXVIII, Schedule No. 4, Line No. 5) .....\$27,721,800  
Less—Portion of plant expenditures considered  
research and development cost (see Exhibit  
XXVIII, Schedule No. 4, Line No. 8) ..... 14,082,900  

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Total depreciable plant .....\$13,638,900  

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Annual depreciation—based on ten year life and  
assuming that salvage will be equal to cost of  
removal .....\$ 1,363,890  

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[4419]

**Exhibit Acker 6**

SUMMARY OF REACTOR PLANT EQUIPMENT AND DEVICES TO BE PURCHASED AND INSTALLED BY APDA FOR TESTING AND TO BE TRANSFERRED TO PRDC AT SALVAGE VALUE AFTER TEST.

	Est. Material Cost*	Est. Installation Labor*	Total	Contingencies*
C-2 Reactor Vessel .....	\$1,062,300	\$ 82,500	\$1,144,800	\$171,600
C-3 Rotating Plug & Drive ....	456,350	50,000	506,350	75,950
C-1 Primary Shield Tank .....	120,000	-0-	120,000	18,000
B-3 Hold Down Mechanism .....	167,500	101,500	269,000	26,900
C-4 Two Control Rods .....	38,000	-0-	38,000	5,700
C-5 Two Control Rod Actuators	56,300	-0-	56,300	8,400
C-8 Offset Element Handling Mech. ....	225,500	60,000	285,500	42,800
C-10 Element Transfer Rotor & Drive .....	115,000	35,000	150,000	22,500
D-1 Sodium Pump .....	146,000	10,000	156,000	46,800
D-1 Check Valve .....	7,700	2,000	9,700	2,900
D-5 Primary System Piping ....	55,000	21,000	76,000	22,700
D-6 6" Blanket Flow Valve ....	10,000	1,000	11,000	3,300
G-6 Reactor Plant Instruments ..	52,500	-0-	52,500	22,500
G-10 Accessory Electric Equipment	79,000	-0-	79,000	30,000
H-4 Initial Operating Supplies ..	100,000	5,000	105,000	31,500
J Const. Plant Equip. & Tools	400,000	-0-	400,000	-0-
Engineering .....	-0-	150,000	150,000	-0-
	<u>\$3,082,150</u>	<u>\$518,000</u>	<u>\$3,600,150</u>	<u>\$531,550</u>

\* Estimated Material and Labor Costs, including allowance for contingencies, derived from PRDC construction estimate, Exhibit XXVII to PRDC Application for License.

[4451]

**Exhibit Acker 7****(PRDC CONSTRUCTION COST ESTIMATES)****PRDC ENRICO FERMI ATOMIC POWER PLANT PROJECT  
SUMMARY CONSTRUCTION ESTIMATE**

	<i>Material &amp; Labor</i>	<i>Contingencies</i>	<i>Total</i>
General fill and site improvements \$	399,000		\$ 399,000
Contingencies at 10% .....		\$ 39,900	39,900
Reactor plant structures .....	4,572,875		4,572,875
Contingencies at 10% .....		457,325	457,325
Reactor plant equipment .....	5,647,450		5,647,450
Contingencies at 15% .....		847,250	847,250
Primary system Na to Na .....	2,008,000		2,008,000
Contingencies at 30% .....		612,000	612,000
Secondary system Na to water....	1,318,000		1,318,000
Contingencies at 30% .....		395,000	395,000
Liquid metal storage .....	533,000		533,000
Contingencies at 30% .....		159,000	159,000
Other reactor plant equipment and facilities .....	3,391,000		3,391,000
Contingencies at 30% .....		1,017,000	1,017,000
Initial operating supplies .....	1,061,000		1,061,000
Contingencies at 30% .....		317,000	317,000
Miscellaneous reactor plant equip- ment and facilities .....	604,000		604,000
Contingencies at 15% .....		90,000	90,000
<b>Total Material, Labor &amp; Contingencies .....</b>	<b>\$19,534,325</b>	<b>\$3,934,475</b>	<b>\$23,468,800</b>
Construction plant, equipment rental, tools and fee .....			\$ 2,977,000
Spare parts, control rods, rod actuators, core and blanket ele- ments .....			160,000
Preoperation testing after con- struction .....			350,000

Personnel training .....	500,000
Initial operation low to full load ..	550,000
Interest during construction .....	1,800,000
Engineering services and expenses .....	900,000
Local taxes, etc. ....	519,200
Working capital .....	1,175,000
<b>Total Estimated Plant Cost ....</b>	<b>\$32,400,000</b>

[4452]

## PRDC ENRICO FERMI ATOMIC POWER PLANT PROJECT

### SUMMARY OF ESCALATION ALLOWANCE FOR MAJOR EQUIPMENT

	<i>Escalation Allowance Included In Estimate</i>
Primary shield tank .....	\$ 10,000
Reactor vessel including steel shielding, internal structures and heating system .....	91,500
Rotating plug including shield disks, index system, controls, drives, Nak and gas seals .....	50,000
Control rods including fast neutron poison .....	24,200
Control rod actuators .....	41,900
Offset element handling mechanism .....	35,000
Element transfer rotor and drive .....	20,000
Containment vessel .....	56,000
<b>Total Escalation Allowance .....</b>	<b>\$328,600</b>
<b>Plant Material and Labor less Escala- tion Allowance .....</b>	<b>\$19,205,725</b>
Escalation Allowance .....	328,600
Contingencies .....	3,934,475
<b>Subtotal .....</b>	<b>\$23,468,800</b>

Total construction plant, spare parts,  
preoperation testing, personnel training  
initial operation, interest, engineering,  
taxes and working capital . . . 8,931,200

Total Estimated Plant Cost . . . \$32,400,000

Note: On equipment not purchased an allowance for escalation is included as a part of the estimated price.

[4453]

### Exhibit XXVII

#### PRDC ENRICO FERMI ATOMIC POWER PLANT PROJECT CONSTRUCTION ESTIMATE

<i>Description</i>	<i>Material</i>	<i>Labor</i>	<i>Total</i>
<i>Structures and Improvements</i>			
<i>General Fill</i>			
1. Dredge and grade fill on site .....		\$ 135,000	\$ 135,000
2. Riprap .....	\$ 12,000	17,000	29,000
<i>Site Improvements</i>			
3. Finish grading and gravel .....	9,000	6,000	15,000
4. Roads and parking area .....	20,000	45,000	65,000
5. Railroad track .....	18,000	22,000	40,000
6. Yard piping all services .....	18,000	27,000	45,000
7. Storm sewers, drains and catch basins .....	10,000	20,000	30,000
8. Yard lighting .....	5,000	10,000	15,000
9. Fencing .....	6,000	4,000	10,000
10. Landscaping .....	5,000	10,000	15,000
Total Material and Labor .....	\$ 103,000	\$ 296,000	\$ 399,000
Contingencies .....	10,300	29,600	39,900
Total .....	\$ 113,300	\$ 325,600	\$ 438,900

**B—Reactor Plant Structures**

1. Reactor containment vessel excavation foundations and external concrete work .....	\$ 228,400	\$ 242,600	\$ 471,000
2. Containment vessel .....	735,250		735,250
3. Internal structural and concrete work and equipment decay tanks .....	841,525	511,490	1,353,015
4. Element decay and storage structure .....	228,585	199,865	428,450
5. Repair shop and shipping .....	86,365	54,795	141,160
6. Office building .....	125,000	150,000	275,000
7. Boiler rooms .....	95,000	125,000	220,000
8. Service building .....	200,000	200,000	400,000
9. Hot cave building .....	15,000	20,000	35,000
10. Sodium storage and inert gas building .....	110,000	115,000	225,000
11. Control room relay and switch-gear rooms .....	35,000	45,000	80,000
12. Electrical equipment room .....	35,000	48,000	83,000
13. Connecting passageways between buildings .....	7,000	9,000	16,000

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[4454]

<i>Description</i>	<i>Material</i>	<i>Labor</i>	<i>Total</i>
<b>Reactor Plant Structures (Contd)</b>			
14. Stack .....	\$ 75,000	\$ 10,000	\$ 85,000
15. Fan rooms and stack .....	15,000	10,000	25,000
Total Material and Labor .....	\$ 2,832,125	\$ 1,740,000	\$ 4,572,875
Contingencies .....	283,275	174,050	457,325
Total .....	\$ 3,115,400	\$ 1,914,800	\$ 5,030,200

## —Reactor Plant Equipment

1. Primary shield tank including steel and graphite shielding gas cooling system and reactor vessel supports .....	\$ 382,500	\$ 95,000	\$ 477,500
2. Reactor vessel including steel shielding internal structures, heating system .....	1,107,300	87,500	1,194,800
3. Rotating plug including shield disks, index system, controls, drives, Nak and gas seals .....	556,350	70,000	626,350
4. Control rods including fast neutron poison ...	213,800	15,000	228,800
5. Control rod actuators ...	282,100	25,000	307,100
6. Ionization chambers .....	30,000	6,000	36,000
7. Overhead crane with gripper 150 t, and auxiliary 25 t, remote control from operating floor ..	175,000	25,000	200,000
8. Offset element handling mechanism .....	266,900	60,000	326,900
9. Element memory system:	220,000	80,000	300,000
10. Element transfer rotor and drive .....	125,000	35,000	160,000
11. Element transfer cask and car .....	400,000	10,000	410,000
12. Element transfer and cleanup .....	200,000	40,000	240,000
13. Underwater hydraulic opr cart .....	80,000	20,000	100,000
14. Decay storage racks .....	550,000	130,000	680,000
15. Decay building gas and water systems and disassembly machinery ..	290,000	70,000	360,000
Total Material and Labor ..	\$ 4,878,950	\$ 768,500	\$ 5,647,450
Contingencies .....	731,750	115,500	847,250
Total .....	\$ 5,610,700	\$ 884,000	\$ 6,494,700

*Liquid Metal System***D—Primary System Na to Na**

1. Sodium pumps including  
sump tanks and drives  
and heating .....

	\$ 480,000	\$ 40,000	\$ 520,000
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**[4455]**

<i>Description</i>	<i>Material</i>	<i>Labor</i>	<i>Total</i>
<b>Primary System Na to Na (Contd)</b>			
2. Pump tank insulation ..	\$ 15,000	\$	\$ 15,000
3. Intermediate heat ex- changer .....	925,000	30,000	955,000
4. Heat exchanger insula- tion .....	15,000		15,000
5. Main loop piping includ- ing blanket flow and overflow piping with supports .....	165,000	65,000	230,000
6. 6" blanket flow control valves (bellows seal) ..	30,000	3,000	33,000
7. Secondary containment and leak detection sys- tem .....	50,000	20,000	70,000
8. Pipe insulation, including boron carbide cover- ing .....	20,000		20,000
9. Overflow tank .....	20,000	5,000	25,000
10. Overflow pumps and mo- tors .....	100,000	25,000	125,000
Total Material and Labor ..	\$ 1,820,000	\$ 188,000	\$ 2,008,000
Contingencies .....	546,000	66,000	612,000
Total .....	\$ 2,336,000	\$ 254,000	\$ 2,620,000

**E—Secondary System Na to Water**

1. Steam generators .....
2. Steam generator insula-  
tion .....



3. Steam generator supports	3,000	1,500	4,500
4. Sodium pumps and drives	390,000	15,000	405,000
5. Pump insulation	7,000		7,000
6. Pump supports	3,000	1,500	4,500
7. Main loop piping, supply and return including supports	102,000	30,000	132,000
8. Pipe heating and controls	14,000	6,000	20,000
9. Secondary containment and leak detection system	40,000	20,000	60,000
10. Pipe insulation	15,000		15,000
Total Material and Labor	\$ 1,194,000	\$ 124,000	\$ 1,318,000
Contingencies	358,000	37,000	395,000
Total	\$ 1,552,000	\$ 161,000	\$ 1,713,000

## F—Liquid Metal Storage

1. Storage tanks, three 15,000 gal, three 6000 gal	\$ 150,000	\$ 30,000	\$ 180,000
2. Tank heating	60,000	30,000	90,000
3. Tank supports	8,000	5,000	13,000
4. Unloading and purification system including Nak cooling	200,000	50,000	250,000
Total Material and Labor	\$ 418,000	\$ 115,000	\$ 533,000

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[4456]

Description	Material	Labor	Total
Contingencies	\$ 125,000	\$ 34,000	\$ 159,000
Total	\$ 543,000	\$ 149,000	\$ 692,000

## G. Other Reactor Plant Equipment and Facilities

1. Hot cave structure and equipment	208,000	56,000	264,000
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2. Conventional physics and chemical laboratory equipment .....	145,000	5,000	150,000
3. Health physics instruments and equipment .....	160,000	40,000	200,000
4. Health physics wiring and conduit .....	15,000	60,000	75,000
5. Inert gas system including vent gas system .....	170,000	80,000	250,000
6. Reactor plant instrumentation and control boards .....	700,000	150,000	850,000
7. Instrument wiring and tubing .....	100,000	100,000	200,000
8. Steam and feedwater piping from steam generator outlet to steam generator enclosure wall ..	150,000	80,000	230,000
9. Steam generator instrumentation including control air compressor, tubing etc. ....	40,000	60,000	100,000
10. Accessory electric equipment .....	616,000	291,000	907,000
11. Emergency power supply equipment .....	150,000	15,000	165,000
Total Material and Labor .. \$	2,454,000	\$ 937,000	\$ 3,391,000
Contingencies .....	736,000	281,000	1,017,000
Total .....	\$ 3,190,000	\$ 1,218,000	\$ 4,408,000

#### H. Initial Operating Supplies

1. Neutron source .....	18,000	2,000	20,000
2. Initial core elements .....	233,000	23,000	256,000
3. Initial blanket elements .....	377,000	143,000	520,000
4. Initial sodium, inert gas, Nak etc. ....	250,000	15,000	265,000
Total Material and Labor .. \$	878,000	\$ 183,000	\$ 1,061,000
Contingencies .....	263,000	54,000	317,000
Total .....	\$ 1,141,000	\$ 237,000	\$ 1,378,000

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[4457]

I—Miscellaneous Reactor Plant  
Equipment and Facilities

Description	Material	Labor	Total
1. Office furniture and equipment .....	\$ 18,000	\$ 2,000	\$ 20,000
2. Transportation equipment .....	5,000		5,000
3. First aid equipment .....	2,000		2,000
4. Maintenance tools and equipment .....	80,000	20,000	100,000
5. Waste disposal equipment .....	24,000	6,000	30,000
6. Shipping casks .....	120,000	6,000	126,000
7. Miscellaneous systems and power plant equipment .....	195,000	35,000	230,000
8. Cold element assembly equipment .....	80,000	11,000	91,000
Total Material and Labor .....	\$ 524,000	\$ 80,000	\$ 604,000
Contingencies .....	78,000	12,000	90,000
Total .....	\$ 602,000	\$ 92,000	\$ 694,000
Total Material and Labor .....	\$18,233,400	\$5,235,400	\$23,468,800

J—Construction plant, equipment rental, tools and fee .....

\$ 2,977,000

K—Spare parts, control rods, rod actuators, core and blanket elements .....

160,000

L—Preoperation testing after construction .....

350,000

M—Personnel training .....

500,000

N—Initial operation low to full load .....

550,000

O—Interest during construction .....

1,800,000

P—Engineering services and expenses .....

900,000

Q—Local taxes etc. ....

519,200

R—Working capital .....

1,175,000

TOTAL ESTIMATED PLANT COST .....

\$32,400,000

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[4458]

PRDC

## ENRICO FERMI ATOMIC POWER PLANT

## A—STRUCTURES AND IMPROVEMENTS

*General Fill and Site Improvements*

The reactor plant site and turbine-generator side, general fill and improvements was prepared by Detroit Edison Company covering the entire project and it was agreed between DE Co and PRDC (in Paragraph 1 of the Steam Agreement of October 20, 1956) to split the cost of common improvements on a 50-50 basis with PRDC adding to these figures any additional improvements required only for the reactor plant.

Attached sheet shows CA Inc.'s estimate of work and portions completed and their actual cost.

This estimate and the actual costs to date are in line with costs experienced by public utilities in developing a new site for a steam electric generating station.

[4459]

## A—STRUCTURES AND IMPROVEMENTS

Description	Material	Estimate Labor	Total Est.	Work Completed Actual Direct Cost to PRDC
<i>General Fill</i>				
1. Fill and muck removal + design		\$135,000	\$135,000	\$152,580.87
*2. Rip-rap .....	\$ 12,000	17,000	29,000*	-0-

*Site Improvements*

**3. Finish grading and gravel .....	9,000	6,000	15,000**	
4. Roads and parking area .....	20,000	45,000	65,000	
5. Railroad track ...	18,000	22,000	40,000	
***6. Yard piping all services .....	18,000	27,000	45,000***	
7. Storm sewers, drains and catch basins .....	10,000	20,000	30,000	
8. Yard Lighting. ...	5,000	10,000	15,000	6,370.47
9. Fencing .....	6,000	4,000	10,000	
10. Landscaping ....	5,000	10,000	15,000	
<hr/>				
Total Labor and Material .....	\$103,000	\$296,000	\$399,000	
Contingencies 10% .....	10,300	27,600	39,900	
<hr/>				
Total Including Contingencies ..	\$113,300	\$325,600	\$438,900	
<hr/>				
Design on Items Engineered by DE Co at 4.5% of direct				Included above

Note: All of the above items except those with asterisks (\*) are to be performed by the DE Co. and PRDC is to be billed for 1/2 of the cost in accordance with the Service Agreement of October 20, 1956. Estimates are those furnished by DE Co. as 1/2 of their anticipated cost.

\* "Rip-rap" costs are now expected to be zero since rip-rap has been obtained from excavation for the reactor containment vessel foundation, without costs over and above those included in excavation estimate, see Page B-1.  
(See Notes continued on next page)

[4469]

## A—Notes (Contd.)

\*\* "Finished grading and gravel fill" is an allowance for leveling and ~~grading~~ the site after construction as is normal practice with all construction work.

\*\*\* "Yard service piping" consists of yard drainage piping, fire protection piping and hydrants, lawn sprinkler piping, etc and is in line with cost of similar work for conventional steam plants.

[4461]

## B—REACTOR PLANT STRUCTURES

## 1. Reactor Containment Vessel Foundations and External Concrete Work

	Material	Labor	Material	Labor
		Lot		\$ 21
* Excavation test pit .....				
* Excavation reactor foundation ..				
Earth—16,200 cu yd) .....				41
Rock— 4,000 cu yd) .....				56
Reinforcing steel .....	450 Ton	\$150	\$125	\$ 67,500
Forms .....	21,000 sq ft	1:00	1.50	21,000
Concrete mix and place .....	5,800 cu yd	18.	8.	104,400
Waterproofing vessel to grade .....	10,000 sq ft	.10	.20	1,000
Flashing and waterstop .....		Lot		2,500
Backfill .....	9,000 cu yd	.50		
Sump and piping .....		Lot		2,000
Pipe sleeves & neutron shields ..		Lot		15,000
** Pregrouting rock .....		Lot		15,000
Total Material and Labor ..			\$228,400	\$242
Total .....			\$471,000	
Contingencies 10% .....			47,100	
Total with Contingencies ..			\$518,100	

\* Excavation estimated at \$46,000 + 10 per cent Contingencies = \$50,600.  
 This work completed—total actual cost (C. J. Rogers Co, Monroe) \$56,500  
 \*\* Pregrouting rock estimated at \$25,450 + 10% Contingencies = 28,000  
 This work completed—total actual cost (Raymond Concrete Pile Co, New York) 19,600

Approximately 90 percent of the remaining work under this item is contracted for on a unit price basis. Most of this is under a contract dated October 26, 1956 between PRDC and Grafton Construction Co of Monroe, Michigan.

To date the work under contract is approximately 75 per cent complete and the contract unit prices and the quantities of work performed

to date indicate this work will be completed for something less than the estimate.

The remaining 10 per cent of the concrete work will not be contracted for until after the containment vessel erection is complete.

There is every indication that when completed, the work under this section will come well within the estimated cost.

This work is very similar to conventional steam electric generating stations. Unit prices and lump sums used for estimating are based on steam plant costs for similar work in Michigan and Ohio.

[4462]

## B—REACTOR PLANT STRUCTURES

### 2. Containment Vessel

Purchased from Chicago Bridge & Iron Company  
under Contract dated December 24, 1956:

	Estimate	Contract Price
72' dia vessel erected. ....	\$566,000	\$553,700
Escalation 10% . . . . .	56,000	(open)
Allowance for extras such as additional air lock doors, change in size of openings, etc. ....	30,000	(open)
Extra for expected 6-day erection work week. . .	12,000	15,000
Allowance for antisweat insulation on vessel above concrete walls. ....	47,000	-
Extra for element exit connections. ....	9,650	(open)
Extra for testing after erection. ....	5,000	5,000
Extra for erection derrick suitable to erect overhead crane. ....	9,000	9,700
Extra for pickling steel. ....	600	(open)
Total . . . . .	\$735,250	\$585,400
Contingencies 10% . . . . .	73,550	
Total with Contingencies . . . . .	\$808,800	

Note: Allowance for escalation of 10% still appears adequate.



[4463]

## B—REACTOR PLANT STRUCTURES

3. Internal Structural and Concrete  
Work and Equipment Decay Tanks

		Mat.	Labor	Material	Labor
Forms .....	12,000 sf @	\$ 1.00	\$ 1.60	\$ 12,000	\$ 19,200
Reinforcing steel .....	107 T @	150.00	135.00	16,050	14,445
Concrete mix and place .....	2,130 cy @	18.00	10.00	38,340	21,300
* Steel plate shielding .....	950 T @	350.00	200.00	332,500	191,000
Floor finish .....			Lot	1,000	3,500
Sump pump & motor & piping .....			Lot	10,000	8,000
Lead shielding .....			Lot	22,000	40,000
** Structural Steel .....	540 T @	300.00	150.00	162,000	81,000
*** Equipment decay tanks .....			Lot	80,135	31,540
# Hold down plate and actuator .....				167,500	101,500
Total Material and Labor				\$841,525	\$511,490
				Total	\$1,353,015
				Contingencies 10%	135,385
				Total with Contingencies	\$1,488,400

\* Bids on steel plate shielding of \$354 per ton have been received. (R. C. Mahon Co)

\*\* Bids on structural steel at \$224 per ton have been received. (Ingalls Iron Works Co)

\*\*\* Equipment decay tanks

Assume 5 tanks required as shown on APDA Dwg 6XN1109.

Assume tanks carbon steel 1" thick with stainless steel liner.

		Mat.	Labor	Material	Labor
5 tanks with stainless liner ..	62 T	\$450.00	\$150.00	\$27,900	\$ 9,300
Tank supports .....	15 T	300.00	115.00	4,500	1,725
Steel covers .....	152 T	300.00	125.00	45,600	19,000
Concrete plugs .....	61 cy	35.00	25.00	2,135	1,525
*** Total Material and Labor				\$80,135	\$31,540
				Total	\$111,685

This estimate based on preliminary APDA design.

# To be purchased by APDA pursuant to proposal from General Electric Company.

[4464]

## B—REACTOR PLANT STRUCTURES

## 4. Element Decay and Storage Building

Estimate based on preliminary APDA and CA Inc. Design.  
Substructure heavy concrete construction.

Superstructure conventional light panel construction.  
Element storage under water.

	Mat	Labor	Material	Labor
Excavation earth .... 3,000 cy		\$ 2.00		\$ 6,000
Forms ..... 25,500 sf	\$ 1.00	1.50	\$ 25,500	38,250
Reinforcing steel .... 195 T	150.00	125.00	29,250	24,375
Concrete mix & place . 2,500 cy	18.00	8.00	45,000	20,000
Waterproofing .....			1,000	3,000
Superstructure walls, panel construction 12,200 sf	1.15	.75	14,030	9,150
Structural steel ..... 100 T	300.00	150.00	30,000	15,000
Roof deck & roofing ... 4,500 sf	1.70	1.50	7,650	6,750
Doors & hardware ...		Lot	10,000	5,000
Hand railing ..... 250 ft	2.50	1.00	625	250
View windows in con- crete .....		Lot	18,000	10,000
Heating, lighting & ventilation .....		Lot	15,000	15,000
Dewatering .....		Lot	3,000	20,000
Overhead crane, 15 ton .1			11,530	4,000
Lead shielding .....		Lot	15,000	15,000
Miscellaneous & paint- ing .....		Lot	3,000	8,000
Total Material & Labor .....			\$228,585	\$199,865
Total .....			\$428,450	
Contingencies 10% .....			42,850	
Total with Contingencies .....			\$471,300	

[4465]

## B—REACTOR PLANT STRUCTURES

## 5. Repair Shop and Shipping Building

Estimate based on APDA preliminary design, conventional construction.

	Material	Labor	Material	Labor
Excavation—500 cu yd .....		\$ 2.00		\$ 1,000
Reinforcing steel—17 T .....	\$150.	125.	\$ 2,550	2,125
Concrete—340 cu yd .....	18.	8.00	6,120	2,720
Forms—5,600 sq ft .....	1.00	1.50	5,600	8,400
Structural Steel—50 T .....	300.	150.	15,000	7,500
Block wall—6,800 sq ft .....	1.15	.75	7,820	5,100
Roof deck and roofing—3,300 sq ft .....	1.75	1.50	5,775	4,950
Crane—50 T .....		Lot	25,000	8,000
Sash and doors .....		Lot	1,500	2,000
Painting and miscellaneous work ..		Lot	2,000	5,000
Heating, ventilation and lighting ..			15,000	8,000
Total Material and Labor .....			\$86,365	\$54,795
Total .....				\$141,160
Contingencies 10 per cent .....				14,140
Total including Contingencies .....				\$155,300

[4466]

## B—REACTOR PLANT STRUCTURES

## 6. Office Building

Reference APDA Drawing 6XN1137

Building approximately 72' x 32' x 66' = 152,724 cu ft

Office buildings average between \$10 and \$25 per sq ft of floor area depending on design, site and refinements

Average steam plant structure cost is approximately \$1.10 per cu ft

Assume office building completed with lighting, heating, plumbing, furniture, partitions etc = \$1.80 per cu ft

$$\$1.80 \times 152,724 \text{ cu ft} = \$274,903$$

Use \$275,000

## Split Between Material and Labor

Material .....	\$125,000
Labor .....	150,000
<hr/>	
Total .....	\$275,000
Contingencies 10 % .....	27,500
<hr/>	
Total with Contingencies .....	\$302,500

[4467]

## - REACTOR PLANT STRUCTURES

## 7. Boiler Rooms

Preliminary design indicated three boiler rooms located around perimeter of the containment vessel each to house one boiler. Heavy construction due to sodium.

Each boiler room approximately  $66' \times 16' \times 33' = 34,848$  cu ft each

Average powerhouse masonry and concrete = \$1.10 per cu ft

Assume heavier construction than powerhouse and smaller volume use \$2.10 per cu ft

$$34,848 \text{ cu ft} \times 3 \times \$2.10 = \$219,542$$

Use \$220,000

## Assume Split Material and Labor

Material .....	\$ 95,000
Labor .....	125,000
<hr/>	
Total .....	\$220,000
Contingencies 10% .....	22,000
<hr/>	
Total with Contingencies .....	\$242,000

[4468]

## B—REACTOR PLANT STRUCTURES

8. *Service Building*

Preliminary design indicates building 36' x 55' x 105' three story structure, first floor heavy concrete construction, remaining two stories conventional construction, masonry or panel.

Building to house laboratories, testing equipment, etc

Assume interior construction more extensive than powerhouse with more office space, lighting, heating, etc. Estimated cost per cu ft \$1.95

$$36' \times 55' \times 105' = 207,800 \times \$1.95 = \$405,170$$

Use \$400,000

Assume Split Material and Labor

Material	\$200,000
Labor	200,000

Total	\$400,000
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Contingencies 10%	\$40,000
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Total with Contingencies	\$440,000
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[4469]

## B—REACTOR PLANT STRUCTURES

9. *Hot Cove Building*

Preliminary design indicates a building approximately 30' x 40' x 12' of mass concrete

Building to be used for inspection, disassembly and testing of radioactive equipment.

Assume mass concrete construction \$2.25 per cu ft

$$30' \times 40' \times 12' = 14,400 \text{ cu ft} \times \$2.25 = \$32,400$$

Use \$35,000

Assume Material and Labor

Split

Material \$15,000

Labor 20,000

Total \$35,000

Contingencies 10% 3,500

Total with Contingencies \$38,500

[4470]

#### B—REACTOR PLANT STRUCTURES

##### 10. Sodium Storage and Inert Gas Building

- Preliminary design indicates building approximately 70' x 70' x 24' with substructure of mass concrete and superstructure of conventional construction.

Building to house sodium storage tanks, sodium cleanup system, sodium heating and unloading facilities, in substructure. Superstructure to house inert gas storage and cleanup system.

Assume substructure cost \$2.60 per cu ft.

Assume superstructure cost \$1.10 per cu ft.

$$70' \times 70' \times 12' = 59,800 \text{ cu ft} \times \$2.60 = \$155,480$$

$$70' \times 70' \times 12' = 59,800 \text{ cu ft} \times 1.10 = \$ 65,780$$

Use  $\$221,260$   
 $\$225,000$

Assume Material and Labor  
 split

Material  $\$110,000$

Labor  $115,000$

Total  $\$225,000$

Contingencies 10%  $22,500$

Total with Contingencies  $\$247,500$

[4471]

## B—REACTOR PLANT STRUCTURES

### 11. Control Room, Relay and Switchgear Rooms

Preliminary design indicates  
 a building approximately  
 36' x 30' x 44' of conventional  
 construction.

Building to house reactor plant  
 controls and electrical  
 switching equipment.

Assume cubic foot cost slight-  
 ly higher than conventional  
 steam plant due to small vol-  
 ume. Use \$1.50 per cu ft.

$$36' \times 30' \times 44' = 47,520 \times \$1.50 = \$79,280$$

Use  $\$80,000$

Assume Material and Labor  
 split:

Material  $\$35,000$

Labor  $45,000$

Total  $\$80,000$

Contingencies 10%  $8,000$

Total with Contingencies  $\$88,000$



[4472]

## B—REACTOR PLANT STRUCTURES

12. *Electrical Equipment Room*

Preliminary design indicates a building approximately 30' x 70' x 44' of light construction adjacent to control room to house electrical equipment — transformers, cubicles, breakers, etc.

Assume cost per cubic foot somewhat less than steam plant construction, use .90 per cu ft.

$$30' \times 70' \times 44' = 92,400 \text{ cu ft} \times .90 = \$83,160$$

Use \$83,000

Assume Material and Labor split:

Material	\$35,000
Labor	48,000

Total	\$83,000
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Contingencies 10%	8,300
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Total with Contingencies \$91,300

[4473]

## B—REACTOR PLANT STRUCTURES

13. *Connecting Passageways Between Buildings*

Enclosed passageways to connect the various buildings so that personnel may travel between buildings without going out of doors. Passageways to be of light construction.

Assume .90/cu ft.  
 $60' \times 15' \times 10' = 9,000 \text{ cu ft @ .90} = \$ 8,100$   
 $150' \times 6' \times 9' = 8,100 \quad @ .90 = \$ 7,290$

Total-	\$15,390
Use	\$16,000

Assume material and labor split

Material	\$7,000
Labor	9,000

Total	\$16,000
Contingencies 10%	1,600

Total with Contingencies \$17,600

[4474]

## B—REACTOR PLANT STRUCTURES

### 14. Stack

Assume stack for disposal of waste gases and vapors required with height of 200 ft above grade. Assume self-supporting concrete stack with concrete foundation.

Top ID 8 ft.

Assume stack cost erected	\$60,000
Foundation Material	15,000
Foundation Labor	10,000

Assume material and labor split

Material	\$75,000
Labor	10,000

Total	\$85,000
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Contingencies 10%	8,500
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Total with Contingencies	\$93,500
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## [4475]

## B—REACTOR PLANT STRUCTURE

15. *Ventilating Rooms for Containment Vessel*

Assume two rooms required to house ventilating containment vessel area above operating floor level. Each building complete with 75 ft steel stack to exhaust hot air above building height.

Assume building size 19' x 20' x 8', of light concrete construction, say \$2.50/cu ft.

$$19' \times 20' \times 8' \times 2' = 6080 \text{ cu ft} \times \$2.50 = \$15,200$$

$$2 \text{ steel stacks erected} \dots\dots\dots = 10,000$$

	\$25,200
Use	\$25,000

Assume material and labor split

Material	\$14,000
Labor	11,000

Total	\$25,000
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Contingencies, 10%	2,500
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Total with Contingencies	\$27,500
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## [4476]

## C—REACTOR PLANT EQUIPMENT

1. *Primary Shield Tank*

\*Chicago Bridge & Iron proposal to APDA for  
 Primary shield tank erected ..... \$106,000\*  
 Allowance extras and escalation for nuclear  
 operation ..... 25,000  
 Provision for additional penetrations, etc  
 Graphite shielding ..... 175,000  
 500,000 lb @ 35¢ per lb  
 Price information obtained from Hanford

Thermal shielding—steel plate .....	52,500
*150 T @ \$350 per T .....	
Cooling channels .....	10,000
Allowance for cooling of graphite .....	
Heat insulation in place .....	50,000
*Escalation .....	14,000*
Erection of graphite shielding, thermal shield- ing and cooling channels .....	45,000
Total .....	\$477,500
Assume Material and Labor split .....	
Material .....	\$382,500
Labor .....	95,000
Total .....	\$477,500
Contingencies 15% .....	61,600
Total Including Contingencies .....	\$539,100

\* Primary shield tank to be purchased (erected) by APDA. Extras, graphite shielding, thermal shielding, cooling channels, insulation, etc., to be purchased by PRDC.

## [4477]

## C—REACTOR PLANT EQUIPMENT

2. *Reactor Vessel Including Steel Shielding, internal structures and Heating System*
  - \*Combustion Engineering Proposal to APDA .....
  - \*Allowance for  
Extras such as loop stub pipings, thermo-  
couples, expansion joints, etc for nuclear  
operation .....
  - \*Escalation .....
  - \*Heating system material .....
  - Heating coils for keeping sodium fluid  
during reactor shutdown .....
  - \*Erection—Estimated weight—250 T .....
  - \*Erection—Heating System .....

\*Steel Shielding and internal structures ... 10,000\*  
 Allowance for miscellaneous plate and  
 structure shapes required for final  
 operation

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\$1,194,800

Split Material and Labor

Material .....\$1,107,300  
 Labor ..... 87,500

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Total .....\$1,194,800  
 Contingencies 15% ..... 179,100

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Total with Contingencies ...\$1,373,900

\* Reactor vessel, heating system, steel shielding and  $\frac{1}{3}$  of extras such as loop stub piping etc. to be purchased and erected by APDA.

\*\* Two-thirds of extras such as loop stub piping, etc. to be purchased by PRDC.

[4478]

C--REACTOR PLANT EQUIPMENT

3. *Rotating Plug Including Shield Disks, Index System, Controls, Drives, Nak and Gas Seals*

\*Rotating Plug—Combustion Engineering Pro-  
 posal by ABDA .....\$346,350\*

\*Index System & Drives—General Electric Pro-  
 posal to APDA ..... 60,000\*

Steel Shield Disks—erected ..... 100,000

90 T @ \$1,100/T based on material prices  
 from GE Co

Nak and Gas Seals erected ..... 20,000

Escalation ..... 50,000\*

\*Erection—200 T @ \$250/T ..... 50,000\*

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\$626,350

## Split Material and Labor.

Material .....\$556,350

Labor ..... 70,000

Total .....\$626,350

Contingencies 15% ..... 93,950

Total with Contingencies .....\$720,300

\* Plug assembly and Index System and Drives to be purchased and erected by APDA.

PRDC to purchase extras, steel shield disks, Nak & gas seals.

[4479]

## C—REACTOR PLANT EQUIPMENT

## 4. Control Rods Including Fast Neutron Poison

Two rods to be purchased by APDA of a total of 8 required.

\* Allis-Chalmers proposals to APDA for 2 rods \$ 34,608\*

Allowance for fast neutron poison for nuclear operation—approx 2 kg of Boron 10 for 2 rods ..... 12,000

(Actual material price is classified information)

Allowance for shielding for nuclear operation 4,900

\* Escalation ..... 3,400\*

\$ 54,008

Assume 10 per cent reduction on remaining 6 rods due to cost of engineering and development in cost of first 2 rods

$\frac{54,008}{2} - 10\% = 24,300 \times 6 = \dots\dots\dots 145,800$

\$199,808

Shim rods—2 required

Fast neutron poison not required

Less difficult design

Assume  $\frac{1}{3}$  cost of control rods

Say \$7,000 each = ..... 14,000

## Installation control and shim rods

Require unloading, handling, cleaning

Assembly and installation—say \$1,500 each

10 rods x \$1,500 = 15,000

Material .....\$213,800

Labor ..... 15,000

Total .....\$228,800

Contingencies 15% ..... 34,200

Total with Contingencies .....\$263,000

\*Two control rods to be purchased by APDA.  
PRDC to purchase all but two rods.

[4480]

## C—REACTOR PLANT EQUIPMENT

## 5. Control Rod Actuators

Two (2) control rod actuators to be purchased by APDA.

Total 10 required.

\*General Electric proposal to APDA for 2 actuators .....\$ 51,200\*

\*Escalation ..... 5,100\*

Allowance for extras for nuclear operation 5,000

Total for two (2) rods .....\$ 61,300

Assume 10 per cent reduction on 6 remaining rods due to engineering and design being complete on first 2

\$61,300 — 10% = \$27,600 x 6 = \$165,600

2

Shim rod actuators—2 required.

Assume same price as control rod actuators

2 x 27,600 = 55,200

Erection.

Includes unloading, storing, handling, installation and test. Say \$2,500 ea

10 x \$2,500 = 25,000



4480

Material .....	\$282,100
Labor .....	25,000
<hr/>	
Total .....	\$307,100
Contingencies 15% .....	92,100
<hr/>	
Total with Contingencies:	\$399,200

- \* APDA to purchase 2 control rod actuators.
- \* PRDC to purchase 8 control rod actuators.

[4481]

#### C—REACTOR PLANT EQUIPMENT

##### 6. Ionization Chambers

Ionization chambers located in shielding around reactor vessel for measurement of neutron and gama ray field intensity.

The design and characteristics of ionization chamber systems is based on a Bendix Report to APDA dated November 17, 1955, and descriptive data and material received from manufacturers supplying equipment of this type, Westinghouse, RCA and others.

Material .....	\$30,000
Labor .....	6,000
<hr/>	
Total .....	\$36,000
Contingencies 15% .....	5,400
<hr/>	
Total with Contingencies	\$41,400

[4482]

#### C—REACTOR PLANT EQUIPMENT

##### 7. Overhead Crane

Overhead crane on circular track mounted near the top of the containment vessel for lifting reactor equipment. Crane with 125 ton main hook and 25 ton auxiliary

hook, each with gripper mechanism for remote operation.

Crane—125 T with 25 T auxiliary hook .....	\$145,000
Remote Controls .....	30,000
Erection .....	25,000
	<hr/>
	\$200,000

#### Split Material and Labor

Material .....	\$175,000
Labor .....	25,000
	<hr/>
Total .....	\$200,000
Contingencies 15% .....	30,000
	<hr/>
Total with Contingencies ...	\$230,000

Purchase of a larger crane has been contracted for by PRDC, by contract with Whiting Corporation dated December 19, 1956:

150 T crane	
30 T auxiliary	
Remote control operation for inside or outside operation .....	\$184,115
Max Escalation not to exceed 5% = \$	9,200

Maximum Price ....	\$193,315
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Original estimate was based on preliminary design.

[4483]

#### C—REACTOR PLANT EQUIPMENT

##### 8. *Offset Element Handling Mechanism*

A device for removing and installing fuel elements in the reactor, to be purchased and erected by APDA.

##### \*General Electric

Proposal to APDA for offset handling mechanism .....	\$195,500*
Allowance for extras for nuclear operation	35,400

Allowance for shielding for nuclear operation .....	6,000
* Escalation .....	35,000
* Erection assume equipment shipped in pieces requiring field assembly, installation and test. Allow .....	60,000
Material .....	266,900
Labor .....	60,000
Total .....	\$326,900
Contingencies 15% .....	48,900
Total with Contingencies ...	\$375,800

\* APDA to purchase and erect offset handling mechanism.  
 PRDC to purchase extras and shielding for nuclear operation.

[4485]

## C—REACTOR PLANT EQUIPMENT

9. *Element Memory System*

An electronic recording device for keeping an automatic inventory of the positions of all core and blanket elements in the reactor, decay storage and in transit.

Estimating figures obtained by APDA mechanical handling section as a result of their conversations with American Machinery and Foundry Company:

Material .....	\$220,000
Labor .....	80,000
Total .....	\$300,000
Contingencies 15% .....	45,000
Total with Contingencies ...	\$345,000

## [4486]

## C—REACTOR PLANT EQUIPMENT

10. *Element Transfer Rotor and Drive*

A device for transferring elements from reactor to transfer cask car.

\*General Electric Co. proposal to APDA ....\$95,000\*

Allowance for Extra for Nuclear Operation .. 10,000

\*Escalation ..... 20,000\*

\*Assume equipment shipped disassembled re-  
quiring field assembly installation and test—

Allow ..... 35,000\*

Material .....\$130,000

Labor ..... 35,000

Total .....\$165,000

Contingencies 15% ..... 24,700

Total with Contingencies ..\$189,700

\*APDA to purchase and assemble element transfer rotor and drive.  
PRDC to purchase extras for nuclear operation.

## [4487]

## C—REACTOR PLANT EQUIPMENT

11. *Element Transfer Cask and Car*

Shielded mobile car for transferring radioactive elements from reactor plant to decay storage. Car to be complete with cooling equipment, element lifting device, storage racks, etc.

This method of element removal has been evaluated by Dr. Zinn and found feasible and he is now engaged in further design work on the cask car.

Estimating figures obtained from American Machinery & Foundry Co. by APLA mechanical handling section as a result of discussions relative to this type of equipment:

Material .....	\$400,000
Labor .....	10,000
<hr/>	
Total .....	\$410,000
Contingencies 15% ..	61,000

Total Including Contingencies ...\$471,000

[4488]

C—REACTOR PLANT EQUIPMENT

12. *Element Transfer and Cleanup*

Equipment necessary for transferring radioactive elements from cask car through a cleanup process to decay storage. Includes crane with gripper mechanism, steam cleaning chamber with air lock valves and necessary steam piping.

Estimating figures obtained from preliminary designs made by APDA mechanical handling section, and information obtained from American Machinery and Foundry.

	Material	Labor
Crane with gripper mechanism remote controlled .....	\$40,000	\$ 5,000
Steam cleaning chamber, stainless steel lined .....	15,000	5,000
3 air lock valves, quick opening ...	45,000	5,000
1 viewing window .....	10,000	3,000
Piping valves and fitting .....	25,000	7,000
Gas cooling system including piping storage and dump tank .....	40,000	8,000
Element pot gripper .....	15,000	5,000
Miscellaneous allowance .....	40,000	2,000
<hr/>		
Total Material and Labor ....	\$230,000	\$40,000
Total .....	\$270,000	
Contingencies 15% .....	40,500	
<hr/>		
Total including Contingencies .....	\$310,500	

[4489]

## C—REACTOR PLANT EQUIPMENT

13. *Underwater Hydraulic Operated Cart*

Cart for receiving elements from steam cleaning system and transporting to storage area. This entire operation is carried on underwater by remote control.

Estimating figures obtained from APDA mechanical handling section and their conversations with manufacturers.

Material .....	\$ 80,000
Labor .....	20,000
<hr/>	
Total .....	\$100,000
Contingencies 15% .....	15,000
<hr/>	
Total with Contingencies ..	\$115,000

[4490]

## C—REACTOR PLANT EQUIPMENT

14. *Decay Storage Racks*

Underwater storage racks for storage of 1200 blanket elements, and 50 core elements stored in movable carts including supports, cart drive, shielding, index system etc. All material to be stainless steel.

Allowance is made for the following items based on very preliminary design.

	Material	Labor	Material	Labor
Blanket element storage racks 1200 racks @ \$ 170		\$ 25	\$204,000	\$ 30,000
Core element storage carts 50 movable carts @	2,400	300	120,000	15,000
Steel cart ring and corer 5,100 sq ft @		.80	.80 40,800	40,800
*Cart Drive and shielding			100,000	15,000

*Index System .....		46,000	15,000
2. sealed valves, for element entrance and exit		15,700	2,700
Graphite shielding-10,000 lb .....	.35	.25	3,500
Plate shielding-60 T ....	350	150	21,000
			9,000
		\$551,000	\$130,000
Total .....		\$681,000	
Contingencies 15% .....		102,100	
Total Including Contingencies ...		\$783,100	

\* (Estimating figures from American Machinery and Foundry Company.)

### [4491]

#### C—REACTOR PLANT EQUIPMENT

##### 15. *Decay Building Gas and Water Systems, and Disassembly Machinery*

Radioactive element storage under water to provide a biological shield requires water purification, filtration and cooling, an inert gas system in areas where elements are transferred from water storage for shipping and also for fire protection. Disassembly machinery designed for underwater operation is required for preparing elements for shipment to government laboratories.

	Material	Labor
Water purification system with radioactive filters 1,000 gpm .....	\$ 50,000	\$10,000
2—Heat exchangers water to air for cooling storage water 500 gpm ....	30,000	10,000
2—Circulating water pumps and motors—500 gpm .....	20,000	5,000
Inert gas system for cooling, and blanket includes piping valves and fittings, filters, etc. ....	40,000	20,000
Disassembly machinery:		
Saw .....	6,000	1,000
Manipulators .....	75,000	10,000



4492

Inspection tables .....	10,000	5,000
Crane .....	15,000	2,000
Miscellaneous .....	44,000	7,000
Total .....	\$290,000	\$70,000
Total Material and Labor ..	\$360,000	
Contingencies 15% .....		54,000
Total including Contingencies ..	\$414,000	

[4492]

## D—PRIMARY SYSTEM Na TO Na

## 1. Sodium Pumps Including Sump Tanks and Drives and Heating

- \*3 pumps required—1 pump to be purchased by APDA pursuant to proposal from Bryon Jackson for \$146,000 and 1 check valve to be purchased by APDA pursuant to proposal from Eduant Values Inc. for \$7,700.

Assume 10% reduction on remaining 2 pumps.

	Material	Labor
*3 pumps and motors .....	\$410,000	\$20,000*
*3—16" pump check valves .....	23,000	5,000*
pump heating .....	15,000	6,000
3 sump tanks and plugs .....	32,000	9,000
	\$480,000	\$40,000
Total .....	\$520,000	
Contingencies 30% .....		156,000

Total with Contingencies ....\$776,000

\* APDA to purchase and install 1 pump and 1 check valve.

PRDC to purchase and install remaining pumps, pump heating, sump tanks and plugs.

[4493]

## D—PRIMARY SYSTEM Na TO Na

2. *Pump Tank Insulation*

Heat insulation

High temperature block, applied to exterior of pump tanks

Estimated installed price for 3 pump tanks including all materials and labor. \$15,000

Contingencies 30% ..... 4,500

Total with Contingencies .....\$19,500

This item not separated between material and labor as insulation is normally purchased applied for a lump sum price.

[4494]

## D—PRIMARY SYSTEM Na TO Na

3. *Intermediate Heat Exchanger*

Three heat exchangers required for transfer of heat for primary sodium cycle to secondary sodium cycle.

Preliminary estimating figures obtained by APDA from Griscom Russell, a heat exchanger manufacturer.

Heat exchangers including supports...\$ 925,000

Erection assume shipped assembled... 30,000

Total .....\$ 955,000

Contingencies 30% ..... 286,500

Total with Contingencies .....\$1,241,500

[4495]

## D—PRIMARY SYSTEM Na TO Na

4. *Heat Exchanger Insulation*

High temperature block applied on the exterior surface of heat exchanger.

Estimate material and labor for insulation in place .....	\$15,000
Contingencies 30% .....	4,500

• Total with Contingencies .....	\$19,500 •
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This item not separated between material and labor as insulation is normally purchased applied for a lump sum price.

[4496]

## D—PRIMARY SYSTEM Na TO Na

5. *Main Loop Piping Including Blanket Flow and Overflow Piping with Supports*

Three Loops. These include:

Approximately 210 ft of 30" piping from reactor to intermediate heat exchangers and pump tanks.

Approximately 200 ft of 16" piping from pump tank check valve to division point between blanket and core section of reactor.

Approximately 120 ft of 14" piping from division point to core inlet plenum chamber.

Approximately 80 ft of 6" piping from division point through throttle valve to blanket inlet plenum chamber.

Approximately 80 ft of 6" piping overflow from top of reactor datum line to overflow tank.

All piping stainless steel. Estimating prices obtained from M. W. Kellogg Company.

4496

*Pipe including heating .....	\$165,000*
*Labor .....	65,000*
Total .....	\$230,000
Contingencies 30% .....	69,000
Total including contingencies .....	\$299,000

- \* APDA to purchase one of 3 loops, in accordance with proposal received by APDA from Kellogg Company for \$59,000.
- \* APDA to install this loop.
- \* PRDC to purchase and install remaining two loops.

[4497]

#### D—PRIMARY SYSTEM Na TO Na

##### 6. 6 Inch Blanket Flow Control Valves with Bellows Seals

3 valves required.

APDA to purchase one valve in accordance with proposal of Copes-Vulcan for \$14,875.

Assume that large amount of engineering required for first valve will not be repeated; remaining two valves should be about one-half the cost of first valve.

*3 Valves .....	\$30,000*
Labor .....	3,000
Total .....	\$33,000
Contingencies 30% .....	9,900
Total with Contingencies .....	\$42,900

- \* APDA to purchase and install one of 3 valves.
- \* PRDC to purchase and install remaining 2 valves.

## [4498]

## D—PRIMARY SYSTEM Na TO Na

7. *Secondary Containment and Leak Detection System*

This system consists of encasing the piping in a metal covering with a space between the main pipe and the covering into which an inert gas blanket is maintained to prevent fire in case of a leak as well as a means of containing and confining a leak. Instruments mounted in this secondary containment will record any leaks which may occur. This is a gas tight carbon steel pipe encasement.

	<i>Material</i>	<i>Labor</i>
690 ft pipe secondary containment.....	\$20,000	\$ 8,000
Secondary containment 3 sodium pumps @ \$10,000 ea .....	30,000	12,000
Total Material and Labor .....	\$50,000	\$20,000
Total .....		\$70,000
Contingencies 30% .....		21,000
Total including Contingencies....		\$91,000

## [4499]

## D—PRIMARY SYSTEM Na TO Na

8. *Pipe Insulation Including Boron Carbide Covering*

## Heat Insulation:

High temperature insulation and a shielding outer covering such as boron carbide

Estimate Material and Labor for insulation in place .....	\$20,000
Contingencies 30 per cent .....	6,000

Total with Contingencies .....\$26,000

This item not separated between material and labor as insulation is normally purchased applied for a lump sum price.

[4500]

## D—PRIMARY SYSTEM Na TO Na

9. *Overflow Tank*

This is a stainless steel tank provided to receive overflow of sodium from the reactor caused by load changes and expansion of sodium due to temperature change.

Tank approximately 8' dia x 38' high. Estimating prices obtained from Pittsburgh Des Moines and Graver tank

Material .....	\$20,000
Labor .....	5,000
<hr/>	
Total .....	\$25,000
Contingencies 30% .....	7,500
<hr/>	
Total with Contingencies .....	\$32,500

[4501]

## D—PRIMARY SYSTEM Na TO Na

10. *Overflow Pumps and Motors*

2 pumps and motors required 300 gpm ea for recirculating sodium from the overflow tank back to the primary sodium system and to sodium cleanup and storage. Pumps will also be used to fill and drain reactor.

Estimating figures obtained from Byron Jackson and Ingersoll-Rand.

2 pumps with motors and plugs, 300 gpm .....	\$100,000
Labor .....	25,000
<hr/>	
Total .....	\$125,000
Contingencies 30% .....	37,500
<hr/>	
Total with Contingencies .....	\$162,500

## [4502]

## E—SECONDARY SYSTEM Na TO WATER

1. *Steam Generators*

Three (3) required for transferring heat from secondary sodium cycle to steam cycle. Each to have a capacity of approximately 350,000 lbs. of steam per hour.

Preliminary estimating figures obtained from B & W and Griscom Russell indicate three (3) steam generators will cost .....

Labor ..... 50,000

Total ..... \$650,000

Contingencies 30% ..... 195,000

Total with Contingencies ..... \$845,000

## [4503]

## E—SECONDARY SYSTEM Na TO WATER

2. *Steam Generator Insulation*

High temperature insulation applied on the outer surface of the steam generators.

Estimated Cost in Place ..... \$20,000

Contingencies 30 per cent ..... 6,000

Total with Contingencies .... \$26,000

This item not separated between material and labor as insulation is normally purchased applied for a lump sum price.

## [4504]

## E—SECONDARY SYSTEM Na TO WATER

3. *Steam Generator Supports*

Concrete and steel foundations required for setting the three steam generators.



Material .....	\$3,000
Labor .....	1,500
<b>Total .....</b>	<b>\$4,500</b>
Contingencies 30 per cent .....	1,300
<b>Total with Contingencies .....</b>	<b>\$5,800</b>

## [4505]

## E—SECONDARY SYSTEM Na TO WATER

4. *Sodium Pumps and Drives*

3 pumps required approximately  $\frac{1}{2}$  capacity of primary sodium pumps. Same type as primary pumps.

Estimating figures obtained from Byron Jackson and Ingersoll-Rand.

	<i>Material</i>	<i>Labor</i>
3 pumps and motors .....	\$360,000	\$ 8,000
Pump heating .....	12,000	4,000
3 suction tanks .....	18,000	3,000
	<u>\$390,000</u>	<u>\$15,000</u>
<b>Total .....</b>	<b>\$405,000</b>	
Contingencies Added 30% .....	121,500	
<b>Total with Contingencies .....</b>	<b>\$526,500</b>	

## [4506]

## E—SECONDARY SYSTEM Na TO WATER

5. *Pump Insulation*

High temperature insulation applied to the exterior surface of the sodium pumps.

Estimated cost insulation in place .....	\$7,000
Contingencies 30% .....	2,100

**Total with Contingencies ....\$9,100**

This item not separated between material and labor as insulation is normally purchased applied for a lump sum price.

## [4507]

## E—SECONDARY SYSTEM Na TO WATER

6. *Pump Supports*

Necessary concrete and steel foundations for setting 3 sodium pumps.

Material .....	\$3,000
Labor .....	1,500

Total .....	\$4,500
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Contingencies 30% .....	1,300
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Total with Contingencies ...	\$5,800
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## [4508]

## E—SECONDARY SYSTEM Na TO WATER

7. *Main Loop Piping, Supply and Return Including Supports*

3 loops consisting of 16" and 12" stainless steel pipe

System runs from intermediate heat exchanger through reactor building to steam generators and return.

Estimating figures obtained from Grinnell.

Approximately 550' pipe .....	\$102,000
Labor .....	30,000

Total .....	\$132,000
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Contingencies 30% .....	39,600
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Total with Contingencies .....	\$171,600
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## [4509]

## E—SECONDARY SYSTEM Na TO WATER

8. *Pipe Heating and Controls*

Necessary electric heating of piping to keep sodium in a liquid state to insure continuous flow through piping.

System consists of standard electric heating coils wrapped around piping with necessary temperature controls.

550' pipe heating and pump tank heating for 3 pumps .....	\$ 14,000
Labor .....	6,000
Total .....	\$ 20,000
Contingencies Added 30% .....	6,000
Total with Contingencies .....	\$ 26,000

## [4510]

## E—SECONDARY SYSTEM Na TO WATER

9. *Secondary Containment and Leak Detection System*

This system consists of encasing the piping in a metal covering with a space between the main pipe and the covering into which an inert gas blanket is maintained to prevent fire in case of a leak as well as a means of containing and confining a leak. Instruments mounted in this secondary containment will record any leaks which may occur. This is a gas-tight carbon steel pipe encasement.

	Material	Labor
Secondary containment—550' pipe ..	\$ 16,000	\$ 8,000
Secondary containment—3 sodium pumps @ \$8,000 .....	24,000	12,000
Total Material and Labor ..	\$ 40,000	\$ 20,000
Total .....	\$ 60,000	
Contingencies 30% .....	18,000	
Total including Contingencies ..	\$ 78,000	

[4511]

## E—SECONDARY SYSTEM Na TO WATER

10. *Pipe Insulation*

High temperature insulation applied to piping.

Insulation material and labor in place .... \$15,000

Contingencies 30% ..... 4,500

Total with Contingencies ..... \$19,500

This item not separated between material and labor as insulation is normally purchased applied for a lump sum price.

[4512]

## F—LIQUID METAL STORAGE

1. *Storage Tanks, 3—15,000 Gal. and 3—6,000 Gal. Tanks*

Tanks suitable for storage of approximately 45,000 gal. of radioactive sodium from reactor plant primary system and 18,000 gal. of nonradioactive sodium from secondary system.

Estimating prices obtained from Chicago Bridge and Iron Co.

6 tanks, 1 stainless, 5 carbon steel.

Material ..... \$150,000

Labor ..... 30,000

Total ..... \$180,000

Contingencies 30% ..... 54,000

Total with Contingencies ..... \$234,000

[4513]

## F—LIQUID METAL STORAGE

2. *Tank Heating*

Electric heating system for keeping sodium in a liquid state for immediate use in the reactor plant as required.

Standard electric heating coils to be attached to the exterior of the storage tanks.

Approximately 10,000 Lf electric coil ..	\$ 60,000
Labor .....	30,000

Total .....	\$ 90,000
Contingencies Added 30% .....	27,000

Total with Contingenoes .....	\$117,000
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[4514]

## F—LIQUID METAL STORAGE

3. *Tank Supports*

Necessary concrete and steel foundations to support sodium storage tanks.

Material .....	\$ 8,000
Labor .....	5,000

Total .....	\$13,000
Contingencies Added 30% .....	3,900

Total with Contingencies .....	\$16,900
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[4515]

## F—LIQUID METAL STORAGE

4. *Unloading and Purification System  
Including Nak Cooling*

System for receiving and unloading sodium from tank trucks or tank cars and filtering and pumping to storage

tanks. Purification system provides continuous filtering and cold trapping and cleanup of sodium in storage and in the reactor primary system. This also includes a Nak cooling system for the cold traps. Estimating data obtained from Byron Jackson, Ingersoll Rand, M. W. Kellogg, Crane Co., Chapman Valve Co., and General Electric.

	<i>Material</i>	<i>Labor</i>
Unloading station .....	\$ 8,000	\$ 2,000
Forwarding pump and motor .....	15,000	3,000
Cold traps and filters .....	35,000	7,000
Piping valves and fittings .....	45,000	12,000
Nak cooling for cold traps .....	8,000	3,000
Heating system for piping and pumps .....	35,000	10,000
Secondary containment .....	15,000	5,000
Inert gas system .....	14,000	5,000
Miscellaneous allowance .....	25,000	3,000
<b>Total Material and Labor</b> ...	<b>\$200,000</b>	<b>\$50,000</b>
<b>Total</b> .....	<b>\$250,000</b>	
<b>Contingencies 30%</b> .....		<b>75,000</b>
<b>Total Including Contingencies</b> .....		<b>\$325,000</b>

### [4516]

## G—OTHER REACTOR PLANT EQUIPMENT, AND FACILITIES

### 1—Hot Cove Structure and Equipment

This equipment and structure to be located in hot cove building consists of 2 concrete rooms approximately 10' x 10' x 10' with 5' thick concrete walls, 4 shielded viewing windows, 2 shielded doors and remote control handling equipment for handling radioactive materials for inspection and testing.

	<i>Material</i>	<i>Labor</i>
2 cove rooms, 5 ft thick concrete ....	\$ 7,000	\$12,000
4 viewing windows .....	40,000	20,000
2 shielded doors .....	14,000	6,000

2 manipulators remote control .....	75,000	6,000
2 saws .....	12,000	3,000
2 cranes remote operated .....	30,000	3,000
Miscellaneous equipment .....	30,000	6,000

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	\$208,600	\$56,000
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Total .....	\$264,000
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Contingencies 30 % .....	79,200
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Total with Contingencies .....	\$343,200
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## [4517]

## G—OTHER REACTOR PLANT EQUIPMENT AND FACILITIES

2. *Conventional Physics and Chemical Laboratory Equipment*

This includes general laboratory equipment to meet general plant requirements and in addition, equipment needed to measure and account for the incoming U-235 and to check physical dimension of incoming fuel elements and if feasible to evaluate the radioactivity potential of each element.

Equipment to consist of work tables and benches, analysis benches, dark room, and developing equipment, laboratory glassware, balances, scales, measuring devices, low intensity radiation sources, geiger counters, etc.

	<i>Material</i>	<i>Labor</i>
Work Tables .....	\$ 15,000	
Analysis Bench .....	10,000	
Developing equipment and dark room .	10,000	
Laboratory glassware .....	10,000	
Laboratory balances .....	5,000	
Scales .....	5,000	
Geiger counters .....	1,500	
Low intensity radiation sources .....	10,000	
Laboratory chemicals and supplies ...	10,000	



Measuring instruments .....	15,000	
Cameras and X-ray equipment .....	45,000	
Miscellaneous .....	8,500	
<hr/>		
Total Material and Labor .....	145,000	\$ 5,000
Total .....	\$150,000	
Contingencies 30% .....	45,000	
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Total including Contingencies .....	\$195,000	

## [4518]

## G—OTHER REACTOR PLANT EQUIPMENT AND FACILITIES

3. *Health Physics Instruments and Equipment*

The instruments and equipment necessary to detect measure and record the radiation etc. in and around the entire reactor plant.

This will consist of portable and mobile instruments, fixed monitors, laboratory devices and personnel monitors.

Estimating data obtained from manufacturers' catalogs and the following manufacturers: Tracer Laboratory, Nuclear Instruments and Chemical Co., Nuclear Measurement Co. and Technical Associates.

## Breakdown of Proposed Instruments

	Material	Labor
Beta gamma counter .....	\$ 3,000	\$ 600
Beta gamma Ion chamber .....	3,000	600
Alpha proportional counters .....	5,000	1,200
Alpha, Beta gamma Ion chamber ....	2,000	500
Neutron counter .....	2,000	500
Gamma Ion chamber .....	2,000	500
Fast neutron recoil proton counter ..	1,000	300
Alpha contamination probe .....	5,000	800
Beta gamma contamination probe ..	6,000	900
Alpha, Beta gamma spot air sampler ..	100	50
Alpha continuous air sampler .....	100	50
Beta gamma continuous air sampler ..	45,000	10,000

Alpha, Beta gamma continuous air sampler .....	55,000	13,000
Spot air sampler (gases) .....	500	50
Continuous air sampler (gases) ....	2,000	500
Alpha, Beta gamma spot water sampler .....	200	50
Alpha counters .....	3,000	600
Beta gamma counters .....	2,500	800
Scalers .....	6,000	1,500
Automatic sample changer .....	10,000	5,800
Film badges Beta gamma .....	500	50
Film badges neutron .....	800	50
Pocket chamber, Beta gamma .....	600	50
Pocket chamber, neutron .....	700	50
Beta gamma Ion chamber, continuous	5,000	1,500

Total Material and Labor ....	\$160,000	\$40,000
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Total .....	\$200,000
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Contingencies 30% .....	60,000
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Total including Contingencies ....	\$260,000
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## [4519]

## G—OTHER REACTOR PLANT EQUIPMENT AND FACILITIES

4. *Health Physics Wiring and Conduit*

This is the necessary wiring and conduit to connect the fixed monitoring instruments to a central laboratory recording system, for continuous monitoring and recording of radiation levels.

Material .....	\$15,000
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Labor .....	60,000
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Total .....	\$75,000
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Contingencies 30% .....	22,500
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Total with Contingencies.	\$97,500
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## [4520]

## G—OTHER REACTOR PLANT EQUIPMENT AND FACILITIES

5. *Inert Gas System Including Vent Gas System*

A system of Argon gas for blanketing all sodium services as a means of level control fire protection, sealing pump shafts, etc., to prevent oxygen contact with sodium. This also includes a system for purifying contaminated gases for reuse.

Includes unloading facilities, storage tanks, piping valves, fittings, compressors, and purification equipment.

Estimating data obtained from M. W. Kellogg, Grover Tank, Lapp Insulator Co., Fisher Governor Co., Robertshaw-Fulton Co., and Linde Air Products.

*Material Labor*

Gas storage tanks—5 tanks .....	\$ 20,000	\$12,000
Distribution piping valves and fittings	65,000	30,000
Contaminated gas storage —2 tanks ..	10,000	5,000
Gas cleanup system including Na bubblers, calcium chip tank, scrubbers, fitters, etc. ....	50,000	20,000
Regulating and control equipment ....	15,000	7,000
Miscellaneous allowance .....	10,000	6,000

Total Material and Labor .....\$170,000 \$80,000

Total .....\$250,000

Contingencies 30% ..... 75,000

Total Including Contingencies .....\$325,000

## [4521]

## G—OTHER REACTOR PLANT EQUIPMENT AND FACILITIES

6. *Reactor Plant Instrumentation and Control Boards*

The instrumentation necessary to permit the operation of the reactor plant from a control room. Instru-

ments to consist of temperature recorders, flow recorders, reactor output level, radiation level, thermocouples, etc.

Estimating data obtained from Leeds & Northrup, Westinghouse, Radiation Counter Laboratories and Minneapolis-Honeywell Regulator Co.

Type, number, etc., obtained from the instrumentation in use in the various test reactors now in operation.

	<i>Material</i>	<i>Labor</i>
<b>Nuclear Instruments:</b>		
Fission products detector .....	\$ 25,000	\$ 6,000
Neutron sensing chambers, Bf <sub>3</sub> proportional chambers, fission chambers .....	18,000	5,000
Servall mechanism .....	25,000	8,000
Electronic recorders. ....	61,000	12,000
Test equipment .....	67,000	15,000
<b>*Nonnuclear Instruments:</b>		
Data loggers, scanning and other miscellaneous devices .....	40,000	20,000
Measuring, recording and control system system for flow, temperature, pressure and level of sodium coolant system and auxiliaries and inert gas blanket system .....	260,000	50,000
Cabinets, panels, bench boards and cubicles .....	150,000	25,000
Allowance for miscellaneous equipment .....	54,000	9,000
<b>Total Material and Labor .....</b>	<b>\$700,000</b>	<b>\$150,000</b>
<b>Total .....</b>	<b>\$ 850,000</b>	
<b>Contingencies 30% .....</b>	<b>255,000</b>	
<b>Total including Contingencies ...</b>	<b>\$1,105,000</b>	

\* APDA to purchase and install certain non-nuclear instruments, estimated at \$75,000. PRDC to purchase and install remainder.

[4522]

## G—OTHER REACTOR PLANT EQUIPMENT AND FACILITIES

7. *Instrument Wiring and Tubing*

The wiring and tubing necessary to connect the instruments located at various parts of the reactor plant with a central control room.

Material .....	\$100,000
Labor .....	100,000
Total .....	\$200,000
Contingencies 30% .....	60,000
Total Including Contingencies ..	\$260,000

[4523]

## —OTHER REACTOR PLANT EQUIPMENT AND FACILITIES

8. *Steam and Feedwater Piping from Steam Generator Outlet to Steam Generator Enclosure Wall*

This is the steam and feedwater piping on the reactor plant side of the division wall between the reactor plant and the turbine-generator plant.

Consists of feedwater piping to steam generators and steam piping from steam generator with necessary valves, fittings, supports and insulation.

	Material	Labor	Material	Labor
Main steam piping—600 ft .....	\$75.00	\$16.66	\$ 45,000	\$10,000
Feedwater piping—600 ft .....	44.16	11.66	26,500	7,000
Main steam manifold .....			25,000	8,000
Pipe supports and hangers .....		Lot	10,000	15,000
Main steam valves—motor operated .....	6,000	4,000	18,000	12,000
Feedwater valves—motor operated ..	3,500	3,000	10,500	9,000
Fittings, elbows, etc .....			10,000	5,000

Insulation .....	4,000	10,000
Miscellaneous allowance .....	1,000	4,000
<b>Total Material and Labor .....</b>	<b>\$150,000</b>	<b>\$80,000</b>
<b>Total .....</b>	<b>\$230,000</b>	
Contingencies 30% .....		69,000
<b>Total with Contingencies .....</b>	<b>\$299,000</b>	

[4524]

## G—OTHER REACTOR PLANT EQUIPMENT AND FACILITIES

9. *Steam Generator Instrumentation Including Control Air Compressor, Tubing, Etc.*

Instruments necessary for measuring and controlling feedwater and steam flow temperature and pressure. Also necessary recording instruments. These instruments to be electric and air operated. This item also includes the necessary wiring and tubing to connect these instruments with a certain control room.

	<i>Material</i>	<i>Labor</i>
Pressure and temperature recorders--		
steam .....	\$10,000	\$ 6,000
Pressure and temperature recorders feed-		
water .....	8,000	5,000
Control air compressor and motors .....	12,000	5,000
Control wiring and tubing .....	10,000	44,000
<b>Total Material and Labor .....</b>	<b>\$40,000</b>	<b>\$60,000</b>
<b>Total .....</b>	<b>\$100,000</b>	
Contingencies 30% .....		30,000
<b>Total including Contingencies ..</b>	<b>\$130,000</b>	

[4525]

## G—OTHER REACTOR PLANT EQUIPMENT AND FACILITIES

10. *Accessory Electric Equipment*

The electrical power system for the reactor plant auxiliaries consists of a 4.8 kv distribution system for large motors and loads, a 480 volt distribution system for small motors and miscellaneous plant loads, a 240-120 volt distribution system for sodium and reactor preheating, a direct current (battery) system for essential plant control, and a small capacity alternate d-c system for essential plant control. The estimated capacity of the system is 12,500 kva. This capacity is to be supplied from an on-the-site DE Co 120 kv substation by two DE Co transformers. Either of these transformers is capable of supplying the reactor plant load.

	<i>Material</i>	<i>Labor</i>
15 kv metal-clad switchgear—17 units ..	\$127,500	\$ 17,000
600 volt metal-clad main switchgear—		
8 units .....	32,000	4,000
600 volt motor control center—250 ckt ..	112,500	25,000
600 volt distribution panels .....	10,000	5,000
Transformers, 4.8 kv/480 v; 750 kva,		
3 phase—2 .....	16,000	3,000
Transformers, 4.8 kv/120-240 y, 100 kva,		
1 phase—6 .....	12,000	3,000
Transformer, 4.8 kv/120 v, 500 kva,		
3 phase—1 .....	5,000	1,500
Transformers miscellaneous .....	12,000	10,000
Lighting .....	40,000	40,000
Conduit and tray system .....	50,000	75,000
Cable—15 kv .....	20,000	7,000
Cable—600 v .....	50,000	20,000
Cable seals .....	30,000	30,000
Grounding system .....	20,000	20,000
Communicating system .....	25,000	10,000
Television system .....	12,000	8,000



4525

## Direct current system

Battery 125 v .....	20,000	3,000
Battery charger .....	5,000	1,500
Diesel driven generator d-c .....	7,000	2,500
Distribution and switching equipment ..	10,000	5,500

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	\$616,000	\$291,000
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*Total .....	\$ 907,000*
Contingencies .....	272,100

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Total with Contingencies .....\$1,179,100

\* APDA to purchase and install certain electrical equipment, estimated at \$100,000. PRDC to purchase and install remainder.

## [4526]

## G—OTHER REACTOR PLANT EQUIPMENT AND FACILITIES

11. *Emergency Power Supply Equipment*

This system is to act as an alternate a-c source for small essential loads such as critical sodium heating zones, fuel cask car, power, reactor building crane, etc. It is not intended to replace the normal power supply for reactor operation.

	Material	Labor
Diesel or gas driven a-c generator .....	\$125,000	\$12,000
Control and switchgear for a-c generator	25,000	3,000
	<hr/>	<hr/>
	\$150,000	\$15,000

Total .....	\$165,000
Contingencies—30 per cent .....	49,500

---

Total with Contingencies .....\$214,500

## [4527]

## H—INITIAL OPERATING SUPPLIES

1. *Neutron Source*

This is an antimony-breyllium alloy placed in the bottom of the two shim rods to provide a measurable base of neutron flux required for starting up reactor.

The design of the neutron source is based on nuclear reactions taken from the Physics Section of the Reactor Handbook.

Desirable neutron flux levels were determined by NDA and APDA calculations.

Material .....	\$18,000
Labor .....	2,000
Total .....	<hr/> \$20,000
Contingencies 30% .....	6,000
Total with Contingencies .....	<hr/> \$26,000

## H-INITIAL OPERATING SUPPLIES

### 2. Initial Core Elements

Preliminary estimates obtained by APDA from Babcock & Wilcox Co, Nuclear Metals and Batell Memorial Institute

91 Core Elements.....	\$212,000
Escalation .....	21,000

### Installation

Assume elements shipped disassembled, unload, handle, clean, and assemble ready for placing in reactor.

Estimate \$250 ea x 91 = \$ 22,750  
Use \$ 23,000

Material .....	\$233,000
Labor .....	23,000

Total .....

Contingencies 30% .....

Total with Contingencies...\$332,800

[4528]

## H—INITIAL OPERATING SUPPLIES

3. *Initial Blanket Elements*

•Preliminary estimates obtained by APDA from Babcock & Wilcox Co, Nuclear Metals and Batell Memorial Institute.

572 Blanket Elements.....	\$343,000
Escalation .....	34,000

## Installation

Assume elements shipped disassembled, require unloading, handling, cleaning and assembling ready for placing in reactor.

Estimate \$250 ea x 572 =	\$143,000
Material .....	\$377,000
Labor .....	143,000
<hr/> Total .....	<hr/> \$520,000
Contingencies 30% .....	156,000
<hr/> Total with Contingencies...	<hr/> \$676,000

[4529]

## H—INITIAL OPERATING SUPPLIES

4. *Initial Sodium Inert Gas, Nak, Etc*

•This includes initial supply of sodium Argon gas and Nak.\* Prices obtained from Ethyl Corporation, Linde-Air Products and Delta Chemical Works.

Initial Sodium 750,000 lb @ .25.....	\$187,500
Initial Argon gas 30,000 cu ft @ .25.....	7,500
Initial Nak 50,000 lb @ 1.00 .....	50,000
Miscellaneous .....	5,000

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\$250,000

Allowance for Unloading.....	15,000
Total .....	\$265,000
Contingencies 30% .....	79,500
Total with Contingencies.....	\$344,500

\* APDA to purchase certain initial operating suppliers, chiefly Na and gas.  
PRDC to purchase remainder.

## [4530]

## I—MISCELLANEOUS REACTOR PLANT EQUIPMENT AND FACILITIES

1. *Office Furniture and Equipment*

Includes desks, chairs, files etc for general plant operation.

Material .....	\$18,000
Labor .....	2,000
Total .....	\$20,000
Contingencies 15 per cent .....	3,000
Total with Contingencies.....	\$23,000

## [4531]

## I°—MISCELLANEOUS REACTOR PLANT EQUIPMENT AND FACILITIES

2. *Transportation Equipment*

Provide for general plant use one utility vehicle such as a panel or pickup truck.

Material .....	\$5,000
Contingencies 15% .....	700
Total with Contingencies .....	\$5,700

[4532]

## I—MISCELLANEOUS REACTOR PLANT EQUIPMENT AND FACILITIES

3. *First Aid Equipment*

Necessary first aid equipment for treatment of minor injuries and initial treatment in case of major accident. Includes stretchers, blankets, bandages, medical supplies and instruments.

Material .....	\$2,000
Contingencies 15% .....	300
Total with Contingencies .....	\$2,300

[4533]

## I—MISCELLANEOUS REACTOR PLANT EQUIPMENT AND FACILITIES

4. *Maintenance Tools and Equipment*

Necessary tools and equipment for carrying on every day plant maintenance and repair.

Consist of small tools, electrically operated hand tools and machine shop equipment such as lathes, drill press, etc.

	Material	Labor
Lathe .....	\$25,000	\$ 6,000
Drill Press .....	5,000	3,000
Milling Machine .....	20,000	5,000
Welding Machine .....	6,000	3,000
Hand Tools .....	19,000	500
Grinder .....	1,000	500
Power Saw .....	4,000	2,000
Total Material and Labor ..	\$80,000	\$20,000
Total .....	\$100,000	
Contingencies 15% .....	15,000	
Total with Contingencies ..	\$115,000	

## [4534]

## I—MISCELLANEOUS REACTOR PLANT EQUIPMENT AND FACILITIES

5. *Waste Disposal Equipment*

Equipment and facilities for holdup of radioactive waste material until sufficiently decayed for safe disposal.

Consist of holdup basin, tanks, piping, etc.

	<i>Material</i>	<i>Labor</i>
Earth diked hold up basin .....	\$ 2,000	\$3,000
2 hold up tanks .....	12,000	1,000
Piping .....	10,000	2,000
Total Material and Labor .....	\$24,000	\$6,000
Total .....	\$30,000	
Contingencies 15% .....		4,500
Total including Contingencies ..		\$34,500

## [4535]

## I—MISCELLANEOUS REACTOR PLANT EQUIPMENT AND FACILITIES

6. *Shipping Casks*

Lead shielded cask suitable for shipping 4 decayed elements per cask from reactor plant to Government laboratory for reprocessing.

Estimating prices obtained from American Machinery and Foundry.

Each cask with inside dimension approximately 3'-6" x 2' x 2'

	<i>Material</i>	<i>Labor</i>
Est each cask .....	\$20,000	\$1,000
Assume 6 casks required.		

Material 6 x \$20,000 = \$120,000  
 Labor 6 x \$ 1,000 = 6,000

Total ..... \$126,000  
 Contingencies 15% ..... 13,800

Total with Contingencies .. \$139,800

## [4536]

## I—MISCELLANEOUS REACTOR PLANT EQUIPMENT AND FACILITIES

7. *Miscellaneous Systems and Power Plant Equipment*

Consists of vacuum cleaning system, compressed air, drinking and service water systems, communication and signal systems, miscellaneous hoists and cranes, portable fire protection equipment, alarm system, etc.

	Material	Labor
Vacuum cleaning system including vacuum cleaner, piping, valves and fittings .....	\$ 25,000	\$ 6,000
House service air compressor and piping .....	30,000	6,000
House service water and drinking water including pumps piping drinking fountains, etc.	45,000	10,000
Intraplant signal system including alarms, wiring, etc. ....	25,000	5,000
Miscellaneous portable hoists and cranes for general station use	25,000	2,000
Portable fire protection equipment .....	10,000	1,000
Miscellaneous allowance .....	35,000	5,000
Total Material and Labor .....	\$195,000	\$40,000
Total .....	\$235,000	
Contingencies 15% .....	35,200	
Total including Contingencies .....	\$270,200	



This item is the same as normally required in conventional steam plants and estimated cost is based on cost of such services in existing utility plants.

## [4537]

## I—MISCELLANEOUS REACTOR PLANT EQUIPMENT AND FACILITIES

8. *Cold Element Assembly Equipment*

Equipment necessary for receiving cleaning and assembly of nonradioactive elements.

Consists of cleaning equipment, work benches and tables, lathes, drill press and hand tools.

Material .....	\$ 80,000
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Labor .....	11,000
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Total .....	\$ 91,000
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Contingencies 15% .....	13,600
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Total with Contingencies .....	\$104,600
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## [4538]

## J—CONSTRUCTION PLANT, EQUIPMENT RENTAL, TOOLS AND FACILITIES

This item includes cost of temporary construction buildings, heating, lighting and plumbing, rental and/or purchase of construction machinery and tools, contractor's supervision and field personnel expenses and fee. Payroll insurance and taxes, welfare contribution, etc.

The allowance for this item is somewhat greater than for a conventional steam plant due to the special nature of this project and the many difficult erection problems involving heavy construction machinery, and the resulting longer construction period.

\* Estimate—\$2,977,000\*

This is approximately 57 per cent of the total estimated labor cost of the project.

A conventional steam plant generally averages between 35 and 40 per cent of total estimated labor cost for the same items.

\* In connection with its major components test program, APDA will bear a portion of these costs, estimated at \$400,000.

### [4539]

#### K—SPARE PARTS

To permit continuous operation spare parts are required for conventional generating plants and likewise are required for reactor plant operation.

Assume following spare parts:

2 spare control rods @ \$24,300 .....	\$ 48,600
2 spare control rod actuators @ \$27,600 .....	55,200
9 spare core elements @ \$2,500 .....	22,500
25 spare blanket elements @ \$700 .....	17,500
Miscellaneous .....	17,200
Total .....	<u>\$160,000</u>

### [4540]

#### L—PREOPERATION TESTING AFTER CONSTRUCTION

This capital item is an expense that occurs before the plant is ready for commercial operation. It includes only operating expenses and does not include any of the costs of money or taxes other than social security taxes.

The expense is incurred after completion of the plant construction and before it becomes critical. It includes final adjustments to all plant equipment, minor changes and an item for inspection and testing of the initial loading of core and blanket elements. In addition the expense covers several weeks that are required for the progressive loading of the reactor core, carefully measuring the approach to criticality after the addition of one-third of the core ele-

ments and again after each additional element is added to the core. The hold-down plate is lowered, the reactor locked and control rods lowered after each element addition.

### 1. Plant Equipment Adjustments

(a) Supervision, operating and maintenance force of 38 men at \$700 per month each for 3 months .....	\$80,000	
(b) Allowance for minor changes and miscellaneous materials .....	20,000	\$100,000

### 2. Reactor Loading Procedure

(a) Supervision, operating and maintenance force of 38 men at \$700 per month each for 3 months .....	\$80,000	
(b) 12 specialized men at \$15,000 per year each for 3 months .....	45,000	
(c) Allowance for outside consulting services .....	25,000	
(d) Allowance for miscellaneous materials .....	50,000	\$200,000

### 3. Other Plant Operating Costs, Administration, Security and Plant Services

(a) Administration and operating costs—10 men at \$700 per month each for 6 months .....	\$42,000	
(b) Plant services 6 months ....	8,000	\$ 50,000
Total .....		\$350,000

[4541]

### M—PERSONNEL TRAINING

This allowance provides for the men that are in training to familiarize themselves with plant operating problems and supervisory duties.

2 men in supervisory training for 2 years	
@ \$12,500 each	\$ 50,000
10 men in operation training for 2 years	
@ \$10,000 each	200,000
20 men in operation training for 1 year	
@ \$10,000 each	200,000
20 men in operation training for 1/2 year	
@ \$10,000 each	100,000
Total	<hr/> \$550,000

Note: Portions of this training will be at operating reactor plants, schools and classes conducted by APDA and PRDC.

#### [4542]

#### N—INITIAL OPERATION LOW TO FULL LOAD

This allowance provides for the cost of one year's operation that is required to bring the reactor to a condition of safe operation at full load. After the reactor becomes critical it is loaded to give a small heat output and the control and safety rods operated to determine their effectiveness. These tests are repeated many times in the process of calibrating control rods and proving that the safety rod characteristics are satisfactory.

After these tests which require several months, other tests estimated to take about 6 months will be performed. These tests required to prove reactor stability include a long series of tests with oscillating reactivity applied to the reactor core with programmed reactor loadings and oscillator frequencies.

The estimate for the year's testing includes:

##### 1. Labor

10 men @ \$15,000	\$150,000	
10 men @ 10,000	100,000	\$250,000

2. *Material and Testing*

(a) Purchase 10 special test core elements @ \$5,000 ea . . . . .	50,000	
(b) Examination of above in outside laboratories after irradiation . . . . .	100,000	
(c) Miscellaneous chemical tests of reactor fluids by outside laboratories . . . . .	25,000	
(d) Plant services . . . . .	25,000	200,000
		<hr/>

3. *Consulting Service Allowance* . . . . . 100,000

Total . . . . . 

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\$550,000

[4543]

## O—INTEREST DURING CONSTRUCTION

Interest is estimated on basis of Loan Agreements for \$15,000,000 to be borrowed during the construction period.

\$1,800,000

See Arthur Anderson calculation in connection with cash flow study.

[4544]

## P—ENGINEERING SERVICES AND EXPENSES

This figure represents estimated costs of engineering services and expenses of Commonwealth Associates Inc. in preparing construction drawings, specifications, purchasing and other special services required by PRDC.

\* Estimated Cost—\$900,000\*

\* In connection with its major components test program, APDA will bear a portion of these costs, estimated at \$150,000.

[4545]

## Q—LOCAL TAXES

Local taxes have been estimated from tax data obtained from the township supervisor and from State Tax Commission Manual and is based on a tax rate of \$44.18 per \$1,000 per year of accumulated value of the property. Taxes are included in the estimate until 1960 when reactor plant goes into operation.

Estimated Taxes—\$519,200

[4546]

## R—WORKING CAPITAL

A Task Committee on Fixed Charges and Financing was appointed by E. W. Morehouse to review electric utility experience and recommend ground rules for use in making economic analyses. R. F. Brower was chairman of the Task Committee. Based on their recommendations the Economics Committee determined that working capital should be a part of the plant investment and should be equal to 4 per cent of the estimate. This is verified in minutes of the Economics Committee meeting of July 22, 1954.

The working capital figure of \$1,175,000, shown in the PRDC Estimate is taken without change from an earlier plant estimate of \$30,496,000 made by APDA and is 4 per cent of the APDA estimate.

[4557]

EXHIBIT ACKER 10  
(Back-up Material for Operation Period Cash Flow Schedules)

## COMPUTATION SHEET SHOWING DERIVATION OF CASH APPLICATION

Lines 5-13, Sched No. 1, Exhibit

Costs in Thousands of Dollars

Reference Line In Exhibit Schedule No. 1	Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	Reference Authority
Lines 5	PRODUCTION COSTS											
	<u>Operation</u>											
	Labor, based on Manning Table (59 men) and 1956 labor costs escalated at 4%, compounded annually.	509	555	576	597	649	674	699	725	752	781	
	Material, estimated no escalation, includes make-up Na, Inert Gas Make-up, Lubricants, etc.	160	160	160	160	160	160	160	160	160	160	
	Sub Total	695	715	736	757	809	834	859	885	912	941	APDA, J. Hanna
	<u>Maintenance</u>											
	Labor, based on Manning Table (9 men) and 1956 labor costs escalated at 4%, compounded annually.	146	154	161	169	178	186	195	205	215	225	
	Material, estimated with no escalation, Piping, Valves Small Parts, Maintenance Supplies, etc.	232	232	232	232	232	232	232	232	232	232	
	Sub Total	378	386	393	401	410	416	427	437	447	457	APDA, J. Hanna
	<u>General Administrative Overheads</u>											
	Administrative Staff, Rent, etc.	70	70	70	70	70	70	70	70	70	70	APDA, J. Hanna
	<u>Auxiliary Services</u>											
	Costs derived from Services Contract and includes com- pressed air, heating steam, general service water, city water and sewage. Computation attached.	49.7	50.3	50.9	51.5	52.2	52.8	53.5	54.2	54.8	55.4	D. E. Co., J. Hart
	<u>Auxiliary Power</u>											
	Computed from power consumption estimates made by APDA Economics Group using a 10 Mill per Kwhr Power Cost.	280	315	552	552	631	684	638	729	729	729	D. E. Co., J. Hart
Line 5	Total, Production Costs	1472.7	1536.3	1801.9	1831.5	1977.2	2063.8	2052.5	2160.2	2217.2	2257.6	

DEH/bhh

February 26, 1957



Reference Line  
in Exhibit  
Schedule No. 1

Line 6.	Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	Reference Authority
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### CORE PROCESSING COSTS

#### Aqueous processing

Process throughput, kg/yr

Cost is derived from a charge of \$102.00 per kg.

#### Clean-up Time

at \$15,300 per day

#### Convert U Salts to Metal

Cost is derived from a charge of \$35 for UNH conversion to  $UF_6$  and \$70 for  $UF_6$  conversion to metal per KG of throughput.

#### Convert PU Salts to Metal

Core PU throughput, kg/yr

Cost is derived from a charge of \$1500 per kg of PU throughput.

#### Scrap Recovery Costs

Cost is derived from a charge of \$67.50 per kg based on 20 per cent of process throughput.

Line 6. Total, Core Processing Costs

778	742	757	849	840	782	725	749	794	795
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Line 7. BLANKET PROCESSING COSTS

#### Aqueous processing

Process throughput, kg/yr

cost is derived from a charge of \$15.30 per kg of throughput.

#### Clean-up Time

\$15,300 per-day

#### Convert PU Salts to Metal

Blanket PU throughput, kg/yr

Cost is derived from a charge of plutonium throughput  
Storage Drum Cost

Line 7. Total, Blanket Processing

235	261	345	431	550	717	713	728	762	761
			310						

Throughput  
Quantities by  
APDA, W. N.  
McDaniels.

Process Costs  
derived from  
Chicago Operations Office,  
USAEC, Teletype  
Feb. 25, 1957.

Throughput  
Quantities by  
APDA, W. N.  
McDaniels.

Process Costs  
derived from  
Chicago Operations Office,  
USAEC, Teletype  
February 25,  
1957.

Jan/Ohh  
February 28, 1957

Reference Line  
In Exhibit  
Schedule No. 1

Reference  
A.1.1.1.1

Line 8

ADDITIONAL FUEL CYCLE COSTS

Core Shipping

Cost is derived from a  
charge of \$20 per kg of  
core process throughput

A.1.1.1.1.1

Blanket Shipping

Cost is derived from a  
charge of \$1 per kg of  
blanket process throughput

A.1.1.1.1.1

Core Fabrication

Core elements fabricated  
per yr.  
Cost is derived from a  
charge of \$2000 per element  
including axial blanket

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Core elements fabricated per yr.	161	180	175	174	167	160	149	136	124	112	100	88
Cost is derived from a charge of \$2000 per element including axial blanket	322	360	350	348	334	304	296	272	248	224	200	176

A.1.1.1.1.1

A.1.1.1.1.1

Blanket Fabrication

Blanket elements fabricated  
per yr.  
Cost is derived from a  
charge of \$600 per element

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Blanket elements fabricated per yr.	101	131	199	243	376	280	350	407	407	411	411	411
Cost is derived from a charge of \$600 per element	61	79	119	146	226	168	210	247	247	247	247	247

A.1.1.1.1.1

A.1.1.1.1.1

Core Material Replacement

U 235 destroyed, kg per yr  
Cost is derived from a  
charge of \$16.40 per kg *gram*  
of U 235 destroyed

A.1.1.1.1.1

A.1.1.1.1.1

Blanket Material Replacement

Depleted U replacement,  
kg per yr.  
Cost is derived from a  
charge of \$2.60 per kg of  
depleted U replacement

A.1.1.1.1.1

A.1.1.1.1.1

Control Poison Replacement

Estimated Cost

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Estimated Cost	2	2	4	4	4	5	5	5	5	5	5	5

A.1.1.1.1.1

Special Material Rental

Kg of U 235 inventory  
at interest on inventory  
valued at \$16.40 per gm

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Kg of U 235 inventory at interest on inventory valued at \$16.40 per gm	1111	1077	800	765	1033	1033	1033	1033	1033	1033	1033	1033
	---	---	---	---	---	---	---	---	---	---	---	---
	---	---	---	---	---	---	---	---	---	---	---	---

A.1.1.1.1.1

A.1.1.1.1.1

Total, additional fuel  
cycle costs

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Total, additional fuel cycle costs	1,202	1,294	1,832	2,237	3,216	3,336	3,361	3,532	3,477	3,477	3,477	3,477

[4560]

Reference Line  
In Exhibit  
Schedule No. 1

Year1961196219631964196519661967196819691970

Reference  
Authority

Line 9

Property Taxes

Plant cost less working  
capital assessed at  
50% with tax rate at  
\$44.18 per \$1000. Tax  
rate provided by French-  
town Township.  
 $\$31,225,000 \times 0.50 \times \$44.18$   
per \$1000.

Frenchtown  
Township  
APDA, J. Hanna

690 690 690 690 690 690 690 690 690 690

Line 10

Insurance, 0.5% on plant  
cost less working capital  
and operation in test year

APDA, J. Hanna

149 149 149 149 149 149 149 149 149 149

Line 11

Interest on Long-term  
bank loan  
4.35% on balance

Loan Agreement

652 653 652 587 500 414 326 239 153 33

Line 13

Payment of Principal on  
Long-term bank loan

Loan Agreement

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DMH/bnh  
February 13, 1957

(Revised February 28, 1957)

## PLANT PERSONNEL

No.	Position	Shift	Number of Men		Salary	Base Plus	Total Payroll
			Per	Total		15% Salary 30% Hourly	Expense 14% Labor Cost Level
<u>SECTION 1</u>							
<u>(a) Administration and Technical</u>							
1.	Plant Superintendent	x	1	1	13,500	15,525	15,525
2.	Asst. Plant Superintendent	x	1	1	11,500	13,225	13,225
3.	Engineering Assistant	x					
4.	Secretary	x	1	1	4,500	5,175	5,175
5.	Clerk	x	3	3	5,000	5,750	17,250
6.	Plant Cleaner	x	1	1	3,600	4,680	4,680
7.	Chief Security Officer	x	1	1	5,600	6,070	6,070
8.	Leader-Security Officer	x	1	3	4,800	5,520	16,560
9.	Security Guard	x	3	14	4,000	5,200	72,800
10.	Chief Chemist	x	1	1	10,000	11,500	11,500
11.	Asst. Chemist	x	1	1	8,000	9,200	9,200
12.	Health Physicist	x	1	4	7,000	8,400	32,200
13.	Nurse	x	1	1	5,000	5,750	5,750
	Subtotal			32			210,535
<u>(b) Plant Operating Force</u>							
14.	Shift Supervisor	x	1	4	9,700	11,155	44,620
15.	Control Operator	x	1	5	7,000	8,050	40,250
16.	Auxiliary Operator	x					
17.	Reactor Operator	x	2	9	6,500	7,480	67,320
18.	Fuel Handling and Refabrication	x	2	9	6,500	7,480	76,000
	Subtotal			27			228,190
<u>(c) Plant Maintenance</u>							
19.	Maintenance Supervisor	x	1	1	10,000	11,500	11,500
20.	Instrument Technician	x	2	2	6,500	7,475	14,950
21.	Mechanic	x	1	1	6,000	7,400	7,800
22.	Electrician	x	1	1	6,000	7,600	7,600
23.	Pipe fitter	x	1	1	6,000	7,600	7,800
24.	Helper	x	3	3	5,000	6,500	19,500
25.	Revolving Maintenance			(added)	37,000	11,650	50,650
	Subtotal			9			120,000
	Total Plant Personnel			68			558,725

Sample Computation Showing 1961 Costs

Administration Technical and  
Operation Labor Cost

$$= 210,535 \times (1.04)^5 = 2535,000 \text{ Assume 4\% escalation, compounded annually}$$

Maintenance Labor Force

$$= 228,190 \times (1.04)^5 = 280,000 \text{ Assume 4\% escalation, compounded annually}$$

CALCULATION OF STEAM REVENUE

REFER TO EXHIBIT      SCHEDULE NO. 1, LINE NO. 1

Year	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>
Net Plant Capability, Kw	103,830	103,830	127,320	127,320	142,620	155,000	155,000	155,000	155,000	155,000
Availability Factor	0.40	0.45	0.70	0.70	0.75	0.75	0.70	0.80	0.80	0.80
Kilowatt Days (1000)	15,150	17,040	32,590	32,590	37,100	42,480	37,700	45,260	45,260	45,260
Labor, M, \$/Hr	3.81	3.96	4.12	4.28	4.45	4.63	4.81	5.00	5.20	5.41
Fuel, F, cents/10 <sup>6</sup> Btu	35.3	36.4	37.5	38.6	39.8	41.0	42.2	43.5	44.8	46.1
Net Megawatt Hours	363,700	406,800	782,000	782,000	938,000	1,020,000	952,000	1,086,000	1,086,000	1,086,000

Steam Revenue Components

Capacity Charge	0	\$ 155,600	\$1,157,000	\$ 850,500	\$1,181,500	\$1,453,000	\$1,466,000	\$1,464,000	\$1,500,000	\$1,517,000
Readiness to Serve	111,000	132,400	261,000	268,500	332,300	376,500	348,000	421,000	433,600	446,100
Energy Charge	1,076,500	1,249,000	2,460,000	2,530,000	3,130,000	3,508,000	3,368,000	3,962,000	4,081,400	4,200,000
Total	\$1,191,000	\$1,537,000	\$3,878,000	\$3,649,000	\$4,644,000	\$5,338,000	\$5,182,000	\$5,867,000	\$6,015,000	\$6,165,000

DEM/bbh

February 13, 1957

(Revised February 28, 1957)

[4563]

ILLUSTRATION OF COMPUTATION PROCEDURE  
USED TO DERIVE STEAM REVENUE

Capacity Charge (C.C.)

$$C.C. = 8.55 (R + M_1) \left[ \frac{A-0.40}{0.30} \right] (C)$$

Where

$$R = 0.80, \text{ years 1 thru 3}$$

$$R = 2.14 - 1.34 \times \frac{155,000}{C}, \text{ years 4 thru 10}$$

$$M_1 = 0.20 \times \frac{M}{3.14}, \quad M \text{ equals manhour rate in year of consideration}$$

A = Availability factor. When equal to or greater than 0.70 the fraction equals 1. When equal to or less than 0.40 the fraction equals zero.

C = Plant Capability

Substituting in the above equation

$$\text{Capacity Charge} = 8.55 \left[ R + (.20 \times \frac{M}{3.14}) \right] \left[ \frac{A-0.40}{0.30} \right] (C)$$

Year 1961

$$\begin{aligned} C.C. &= 8.55 \left[ .80 + (.20 \times \frac{3.81}{3.14}) \right] \left[ \frac{0.40-0.40}{.30} \right] [103,830] \\ &= 8.55 \left[ .80 + .243 \right] [0] [103,830] \\ &= 0 \end{aligned}$$

Year 1962

$$\begin{aligned} C.C. &= 8.55 \left[ .80 + (.20 \times \frac{3.96}{3.14}) \right] \left[ \frac{.45-0.40}{.30} \right] [103,830] \\ &= 8.55 \left[ .80 + .252 \right] [.168] [103,830] \\ &= 8.55 [1.052] [.168] [103,830] \\ &= \$155,600 \end{aligned}$$

Year 1963

$$\begin{aligned} C.C. &= 8.55 \left[ .80 + .20 \times \frac{4.12}{3.14} \right] \left[ \frac{.70-0.40}{.30} \right] [127,320] \\ &= 8.55 [1.063] [1] [127,320] \\ &= \$1,157,000 \end{aligned}$$



[4564]

- 2 -

Year 1964

$$\begin{aligned}
 C.C. &= 8.55 \left[ 2.14 - 1.34 \left( \frac{155,000}{127,320} \right) + (.20 \times \frac{M}{3.14}) \right] \left[ \frac{A-.40}{.30} \right] \left[ \begin{array}{c} \text{Plant} \\ \text{Capability} \end{array} \right] \\
 &= 8.55 \left[ 2.14 - 1.34 \left( \frac{155,000}{127,320} \right) + (.20 \times \frac{4.28}{3.14}) \right] \left[ \frac{.70-.40}{.30} \right] [127,320] \\
 &= 8.55 [2.14 - 1.63 + .273] [7] [127,320] \\
 &= \$850,500
 \end{aligned}$$

Year 1965

$$\begin{aligned}
 C.C. &= 8.55 \left[ 2.14 - 1.34 \left( \frac{155,000}{142,620} \right) + (.20 \times \frac{4.45}{3.14}) \right] \left[ \frac{.75-.40}{.30} \right] [142,620] \\
 &= 8.55 [2.14 - 1.455 + .283] [1] [142,620] \\
 &= 1,181,500
 \end{aligned}$$

Year 1966

$$\begin{aligned}
 C.C. &= 8.55 \left[ 2.14 - 1.34 \left( \frac{155,000}{155,000} \right) + (.20 \times \frac{4.63}{3.14}) \right] \left[ \frac{.75-.40}{.30} \right] [155,000] \\
 &= 8.55 [2.14 - 1.34 + .295] [1] [155,000] \\
 &= \$1,453,000
 \end{aligned}$$

Years 1967 thru 1970

Repeat year 1966 procedure using appropriate numbers from attached schedule.

Readiness-to-Serve (R)

$$R = \$0.066 (M_2 + F_2) \text{ (Kilowatt days)}$$

Where

$$M_2 = 0.03 \times \frac{M}{33.14}; \text{ M equals manhour rate in year of consideration}$$

$$F_2 = 0.97 \times \frac{F}{80.31}; \text{ F is the average fuel cost per million Btu of Edison's steam production system}$$



[4565]

- 3 -

Substituting in the above formula

$$R = \$0.0066 \left[ (.03 \times \frac{M}{3.14}) + (.97 \times \frac{F}{0.31}) \right] \text{ [kilowatt days]}$$

Year 1961

$$R = \$0.0066 \left[ (.03 \times \frac{3.81}{3.14}) + (.97 \times \frac{.353}{.31}) \right] \text{ [15,150,000]}$$

$$R = \$0.0066 \left[ .0364 + 1.105 \right] \text{ 15,150,000}$$

$$= \$114,000$$

Year 1962

$$R = \$0.0066 \left[ (.03 \times \frac{3.96}{3.14}) + (.97 \times \frac{.364}{.31}) \right] \text{ (17,040,000)}$$

$$= \$132,400$$

Year 1963

$$R = \$0.0066 \left[ (.03 \times \frac{4.12}{3.14}) + (.97 \times \frac{.325}{.31}) \right] \text{ (32,590,000)}$$

$$R = \$261,000$$

Years 1964 thru 1970

Calculated in a similar manner using appropriate values from attached schedule.

Energy Charge (E)

$$E = .0026 \times \frac{F}{0.31} \times \text{Net Kilowatt hours}$$

Where

F = the average fuel cost per million Btu of Edison's steam production system

Year 1961

$$E = .0026 \times \frac{.353}{.31} \times 363,700,000$$

$$= \$1,076,500$$

Year 1962

$$E = .0026 \times \frac{.364}{.31} \times 408,800,000$$

$$E = \$1,249,000$$

[4566]

- 4 -

Reference Line  
In Exhibit  
Schedule No. 1

Years 1963 thru 1970

Computed in a similar manner using appropriate values from  
attached schedule.

1969

1970

Reference  
Authority

Line 8

ADDITIONAL FUEL CYC

Core Shipping

Cost is derived  
charge of \$20 per  
core process tr

NOTE: Factor F is the cost of fuel escalated 3% compounded annually  
using a 1956 base figure of 30.5 cents per million Btu.

Factor M is the manhour rate escalated 4% compounded annually  
using a 1956 base figure of \$3.14/hr.

APDA, J. Hanna

Blanket Shipping

Cost is derived  
charge of \$1 per  
blanket process

APDA, J. Hanna

Core Fabrication

Core elements f  
per yr.  
Cost is derived  
charge of \$2000  
including axi

164

164

APDA, J. Hanna

328

328

APDA, J. Hanna

Blanket Fabricati

Blanket elements  
per yr.  
Cost is derived  
charge of \$600

DEH/bhr/emr  
2-13-57

407

407

APDA, J. Hanna

244

244

APDA, J. Hanna

Core Material Repl

U 235 destroyed,  
Cost is derived  
charge of \$16.40  
of U 235 destr

APDA, J. Hanna

AEC

Blanket Material R

Depleted U repla  
kg per yr.  
Cost is derived  
charge of \$2.50  
depleted U repla

APDA, J. Hanna

AEC

Control Poison Repl

Estimated Cost

5

5

APDA, J. Hanna

Special Material Re

Kg of U 235 inven  
Interest on in  
valued at 15.40

1033

1033

APDA, J. Hanna

676

676

AEC

677

677

Total, additional  
cycle costs

318

Line 6

DEH/bhr/emr  
February 28, 1957

Continued  
**CALCULATION OF PLUTONIUM REVENUES**

Refer to Exhibit XIII, Revised, Schedule No. 1, Line No. 2

<u>YEAR</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>Reference Authority</u>
<u>Operating Data</u>											
Reactor Power Level, mw Heat	300	300	350	350	400	430	430	430	430	430	
Load Factor	0.40	0.45	0.70	0.70	0.75	0.75	0.70	0.80	0.80	0.80	
Reactor Output, mw yrs.	120	135	245	245	300	322	301	344	344	344	
Burn-up, Per cent	1.0	1.5	2.0	2.0	2.5	3.0	3.0	3.0	3.0	3.0	AFDA, J. Hanna

Plutonium Production

Gross Production, kg.yr.

Net Production, kg.yr.

Deduct 1% loss

Plutonium Unit Price,  
\$ Per gm.

(ABC schedule of  
prices and charges,  
letter, Jan. 5, 1955  
(Classification status  
Confidential)

Plutonium Revenues, \$1000,    1383    1864    2987    4076    5526    6228    6313    6497    6888    6861

TOTAL

48673    AFDA, J. Hanna

[4567]

4567

[4568]

## COMPUTATION OF ANNUAL CHARGES FOR AUXILIARY SERVICES

## BASED ON SERVICES CONTRACT

INCLUDED IN "PRODUCTION COSTS" EXHIBIT

SCHED NO. 1 LINE 5

Building Heat Charge

## Rate Structure:

Demand Charge: \$0.45 per yr per pound.

Consumption Charge: \$0.85 per 1000

Fuel adjustment: 1.0 cents per 1000 pounds of steam consumed for each full  
8 cents increase in the cost of fuel above 65 cents per  
million BTU.

## COMPUTATION OF BUILDING HEAT CHARGE

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Fuel Adjustment	40 cents	44 cents	48 cents	52 cents	56 cents	60 cents	64 cents	68 cents	73 cents	77 cents
Base price	85 cents	85 cents	85 cents	85 cents	85 cents	85 cents	85 cents	85 cents	85 cents	85 cents
Total Rate	1.25	1.29	1.33	1.37	1.41	1.45	1.49	1.53	1.58	1.62
*1 Consumption Charge	\$19,625	20,225	20,825	21,425	22,125	22,725	23,425	24,125	24,725	25,325
*2 Demand Charge	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200
Total	\$26,825	27,425	28,025	28,625	29,325	29,925	30,625	31,325	31,925	32,525

\*1 Based on an annual consumption of 15,700,000 # of steam.

\*2 Based on 16,000 #/Hr demand.

Potable Water Charge

## Rate Structure:

Service Charge: \$1,425.00 per month

Consumption Charge: 10 cents per 1000 gal

## COMPUTATION OF POTABLE WATER CHARGE

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Service Charge	\$17,100	\$17,100	\$17,100	\$17,100	\$17,100	\$17,100	\$17,100	\$17,100	\$17,100	\$17,100
Consumption Charge*	400	400	400	400	400	400	400	400	400	400
Total	\$17,500	\$17,500	\$17,500	\$17,500	\$17,500	\$17,500	\$17,500	\$17,500	\$17,500	\$17,500

\*Based on 4,000 M Gal per yr.

DEH/bhh

February 13, 1957

(Revised February 28, 1957)

[4569]

Computation of annual Charges for Auxiliary Services  
Based on Services Contract (Cont'd)

General Service Water Charge  
Rate Structure:

Service Charge: \$125.00 per month for first 1000 GPM  
 \$10.00 per month per 100 gpm for next 2,000 gpm.

Consumption Charge: 0.1 cents per 1000 gal.

COMPUTATION OF GENERAL SERVICE WATER CHARGE

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Service Charge	\$3,900	\$3,900	\$3,900	\$3,900	\$3,900	\$3,900	\$3,900	\$3,900	\$3,900	\$3,900
Consumption Charge*	1,025	1,025	1,025	1,025	1,025	1,025	1,025	1,025	1,025	1,025
	\$4,925	\$4,925	\$4,925	\$4,925	\$4,925	\$4,925	\$4,925	\$4,925	\$4,925	\$4,925

\* 1,025,000 M Gal per yr usage.

Compressed Air Charge  
Rate Structure:

Minimum Charge: \$37.50 per month, 100 GPM contract demand.

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Minimum charge	\$450	\$450	\$450	\$450	\$450	\$450	\$450	\$450	\$450	\$450

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Total auxiliary Services Cost	\$47,700	\$50,300	\$50,900	\$51,500	\$52,200	\$52,800	\$53,500	\$54,200	\$54,800	\$55,400

DEM/bhh  
 February 13, 1957

(Revised February 28, 1957)

# LOCAL PROPERTY TAX CALCULATION

Frenchtown Township Supervisor  
Furnished Tax Rate.

## ITEM Q

<u>TAX YEAR</u>	<u>1957</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>
1956 Material & Labor	735,000	735,000	735,000	735,000
1956 Construction Plant	75,000	75,000	75,000	75,000
1957 Material & Labor		5,005,000	5,005,000	5,005,000
1957 Construction Plant		550,000	550,000	550,000
1958 Material & Labor			8,110,000	8,110,000
1958 Construction Plant			775,000	775,000
1959 Material & Labor				6,257,900
1959 Construction Plant				1,262,000
TOTAL	810,000	6,365,000	15,250,000	25,409,900
	$\frac{810,000}{4} \times \frac{44.18}{1000} =$	$\frac{6,365,000}{4} \times \frac{44.18}{1000} =$	$\frac{15,250,000}{4} \times \frac{44.18}{1000} =$	$\frac{25,409,900}{4} \times \frac{44.18}{1000} =$
TAX BY YEAR, Payable as of January 1.	<u>8,924.36</u>	<u>70,290.38</u>	<u>168,411.16</u>	<u>271,631.36</u>

SUMMARY: 1957  
1958  
1959  
1960

8,924.36  
70,290.38  
168,411.16  
271,631.36  
519,260.26

[4570]

4570



[4573]

**Exhibit Acker 12**

(LETTERS OF PRDC MEMBERS WAIVING REGULATORY AGENCY APPROVALS AS CONDITION UPON CONTRIBUTION TO PRDC; ONLY ONE SAMPLE PRINTED.)

**ALABAMA POWER COMPANY**

Birmingham 2, Alabama

December 27, 1956

Received

Dec 31 1956

Power Reactor Development Company

P. R. D. C.

1911 First Street

Detroit 26, Michigan

Gentlemen:

By letter dated October 23, Alabama Power Company agreed to contribute to Power Reactor Development Company the sum of \$160,000 per year for five years, commencing with the year 1956, subject to call by Power Reactor Development Company. This commitment was made subject to the obtaining by the Company of satisfactory approval and consent of any public regulatory agencies having jurisdiction. We deem it unnecessary to obtain Commission approval and, therefore, waive the condition of our commitment letter providing for satisfactory approval and consent of regulatory agencies.

Yours very truly,

**ALABAMA POWER COMPANY**

By WALTER BOULL

*Executive Vice President*

WB/w



[4594]

**Exhibit Acker 13**

(ORDERS OF REGULATORY COMMISSIONS WITH  
RESPECT TO GUARANTEE AGREEMENTS AND  
CONTRIBUTIONS; ONLY ONE SAMPLE  
PRINTED)

ROCHESTER GAS AND ELECTRIC CORPORATION  
East Avenue, Rochester, N. Y.

R G. and E  
(Names Illegible)

RWH Feb 26 1956  
Telephone  
LOcust 2-7000

February 25, 1957

Received  
Feb 29 1957  
P. R. D. C.

Mr. Robert W. Hartwell,  
General Manager,  
Power Reactor Development Company,  
1911 First Street,  
Detroit, Michigan.

*Re: Bank Loan Guaranty.*

Dear Mr. Hartwell:

I am pleased to send you herewith two copies of an Order issued by the New York State Public Service Commission on February 18, 1957 authorizing this Company to execute a Guaranty Agreement covering 1.80% of the principal amount (\$15,000,000) of the loan negotiated with

the five New York banks by the Power Reactor Development Company.

This will also confirm to you our waiver of the condition with respect to regulatory agency's approval set forth in our letters of February 1, 1957 and October 30, 1957 in connection with our commitment to make contributions to the Power Reactor Development Company.

Very truly yours,

R. E. GINNA,  
ROBERT E. GINNA,  
*President.*

REG:MP  
Encls.

[4595]

STATE OF NEW YORK  
PUBLIC SERVICE COMMISSION

At a session of the Public Service  
Commission held in the City of  
New York on February 18, 1957.

Received 2/22/57

REG

COMMISSIONERS PRESENT

Benjamin F. Feinberg, Chairman

Spencer B. Eddy

Glen R. Bedenkapp

Francis T. Mylott

Richard H. Balch

Aaron L. Jacoby

CASE 18122—Petition of Central Hudson Gas & Electric Corporation, Long Island Lighting Company, and Rochester Gas and Electric Corporation for authority to ex-

4595

ecute an agreement guaranteeing notes to be issued by Power Reactor Development Company.

\* \* \* \* \*

A joint petition having been filed November 14, 1956, by Central Hudson Gas & Electric Corporation, Long Island Lighting Company and Rochester Gas and Electric Corporation for authority to execute a guaranty agreement, substantially in the form of Annex C to Exhibit A attached to the petition, under which petitioners would severally guarantee payment when due of a percentage, as provided in said agreement, of the principal of and interest on notes to be executed by Power Reactor Development Company, a nonprofit membership corporation organized and existing under the laws of the state of Michigan, the proceeds from such notes to be used by Power Reactor Development Company, together with other funds, to design, construct and operate one or more experimental nuclear power reactors, and public hearing after due notice having been held, and the Commission having determined that, subject to the conditions hereinafter stated and not otherwise, participation by petitioners as proposed in such experimental project is in the public interest and that the execution by petitioners of said guaranty agreement is reasonably required for such purpose, and that any payments made by petitioners under or in pursuance of said agreement will be chargeable to operating expenses, it is

[4596]

ORDERED

1. That Central Hudson Gas & Electric Corporation, Long Island Lighting Company, and Rochester Gas and

Electric Corporation be and they hereby are authorized to execute and issue, not later than April 1, 1957, a guaranty agreement substantially in the form of, and in amounts of principal and interest not in excess of those specified in, Annex C to Exhibit A attached to the petition herein. \

2. That within ten days after execution and issuance of the guaranty agreement as herein authorized, each of the said petitioners shall file a verified report thereof in conformity with the Commission's order in Case 6422.

3. That within ten days after execution and issuance of the guaranty agreement as herein authorized, a certified copy thereof in the form as executed shall be filed on behalf of petitioners.

4. That any payments made by petitioners, or any of them, under or in pursuance of said agreement shall be charged to Account 801-Miscellaneous General Expenses.

5. That this order shall be without force or effect until there has been filed with this Commission unconditional acceptances by Central Hudson Gas & Electric Corporation, Long Island Lighting Company, and Rochester Gas and Electric Corporation agreeing to obey all of the terms, conditions and requirements of this order, and that if such acceptances are not filed within a period of twenty days from the date of service of this order, this order shall be null and void.

By the Commission,

ALTON G. MARSHALL,

Secretary.

[SEAL] [SIGNED]

HTO'B LM

[4597]

STATE OF NEW YORK  
PUBLIC SERVICE COMMISSION

CASE 18122—Petition of Central Hudson Gas & Electric Corporation, Long Island Lighting Company, and Rochester Gas and Electric Corporation for authority to execute an agreement guaranteeing notes to be issued by Power Reactor Development Company.

APPEARANCES:

Kent H. Brown, Counsel (by Barbara M. Suchow and Morton L. Simons, Assistant Counsel), for the Public Service Commission.

David K. Kadane, 250 Old Country Road, Mineola, N. Y., General Counsel, Long Island Lighting Company and other petitioners herein.

Gould & Wilkie (by M. S. Lockhart of counsel), 1 Wall Street, New York City, attorneys for Central Hudson Gas & Electric Corporation.

Robert E. Ginna, President, Rochester Gas and Electric Corporation, 29 East Avenue, Rochester, N. Y.

T. J. BRADY, Examiner:

This proceeding is upon a joint petition filed by Central Hudson Gas & Electric Corporation, Long Island Lighting Company and Rochester Gas and Electric Corporation for authority, pursuant to Section 69 of the Public Service Law, to execute an agreement whereby each of the petitioners would guarantee a certain percentage of notes aggregating \$15,000,000, payable to a group of banks by Power Reactor Development Company (PRDC).

PRDC was organized in August, 1955 under the Membership Corporation Law of the State of Michigan, as a non-profit corporation, having no shares of stock. The petitioners herein are and have been participating in the nuclear power project of PRDC, which was organized for the purpose of advancing the art and technology of the production of heat energy through the use of fissionable materials for the generation of electric power. This project was conceived in response to the provisions of the Atomic Energy Act of 1954, which encouraged civilian participation in the development of atomic energy for peacetime purposes.

The Securities and Exchange Commission ruled, on January 18, 1957, that PRDC was not to be considered an electric utility company for the purposes of the Public Utility Holding Company Act of 1935.

[4598]

Associated with PRDC in this project is an organization known as Atomic Power Development Associates (APDA), a non-profit company organized under the laws of New York State. Its principal purpose is to conduct studies and research as to economic methods of producing and utilizing nuclear materials and atomic energy, primarily for the generation of electric power, and also for such other industrial and commercial applications as appear to be of practical value. APDA designed the reactor which PRDC now proposes to construct and operate.

Mr. Ernest R. Acker, who is president, general manager and a director of Central Hudson, testified in support of

the petition herein, and characterized APDA as "the research and design organization" and PRDC as "the constructing organization to go through with completion of the project".

The three petitioners herein are members of APDA and PRDC.

The membership of PRDC consists of 21 corporations, of which seven are industrial corporations, 13 are operating electric utility corporations, and one is a service corporation (Southern Services, Inc.), representing four operating electric corporations and their holding company (The Southern Company). There is no written instrument evidencing membership. None of the net earnings of PRDC may inure to the benefit of any member corporation and, upon dissolution, any remaining assets must be contributed to a scientific or educational institution for the promotion of the same aims and purposes for which PRDC was formed.

The plant which PRDC now has under construction is known as the Enrico Fermi Atomic Power Plant, located at Lagoona Beach, Michigan, on Lake Erie. It is described as a fast neutron breeder reactor. It will produce both steam and plutonium and, in the process, will actually produce more fissionable material than it consumes, according to Mr. Acker. The plant is designed to have a nominal steam capacity equivalent to 100,000 kw of electricity, but it is expected that it will actually produce steam equivalent to 150,000 kw of electrical capacity, and the turbine generating plant to be built adjacent to the reactor by Detroit Edison Company will have that rated capacity. Construction is expected to be.



## [4599]

completed by December, 1959, after which there will be a year of testing followed by ten years of operation.

All of the steam produced at the reactor will be purchased by Detroit Edison and all of the plutonium will be purchased by the United States Government at prices to be fixed by it.

The total cost of construction of the project is estimated to be \$43,216,000. This is to be financed by direct money contributions by the member corporations, aggregating \$23,540,000, bank loans totaling \$15,000,000, and contributions of services by APDA valued at \$7,000,000. Thus, the total financial resources to be made available to PRDC amount to \$45,540,000. The excess over construction cost is to be used as working capital.

The three petitioners herein have committed themselves to make direct contributions to PRDC in the following amounts:

Central Hudson .....	\$200,000
Rochester .....	\$450,000
Long Island .....	\$620,000

These contributions are payable over a five-year period and are not refundable. As of the date of the hearing in this matter, Central Hudson had already contributed \$20,000, Long Island had contributed \$62,000, and Rochester was expected to make its initial contribution of 10 per cent of its commitment very shortly thereafter. The record indicates that in accounting for these expenditures the companies have charged them directly to Account 801—Miscellaneous General Expenses, an operating expense

account. This treatment is in accordance with the provisions of the Uniform System of Accounts. Since these amounts are not large in relation to the operations of the petitioners, it is expected that the contributions will be charged off in the year in which they are made, so that there will be no deferral in accounting therefor.

According to Mr. Acker, arrangements have been concluded whereby PRDC is to borrow \$15,000,000 from certain banking institutions. Because PRDC is a new corporation with no credit standing and because of the many uncertainties as to

[4600]

the future operation of this research and developmental project, it was necessary for certain member corporations of PRDC to agree to guarantee stated percentages of the loans. These guarantees cover both principal and interest. The member corporations and the respective percentages of the loans to be guaranteed by them are as follows:

Central Hudson Gas & Electric Corporation .....	80%
The Cincinnati Gas & Electric Company .....	1.00
Columbus and Southern Ohio Electric Company .....	1.00
Consumers Power Company .....	10.00
Delaware Power & Light Company .....	1.20
The Detroit Edison Company .....	58.84
Iowa-Illinois Gas and Electric Company .....	.48

Long Island Lighting Company	2.48
Philadelphia Electric Com- pany .....	10.00
Potomac Electric Power Com- pany .....	3.20
Rochester Gas and Electric Corporation .....	1.80
The Southern Company .....	8.00
Wisconsin Electric Power Com- pany .....	1.20

The record indicates that, if and when the petitioners herein are required to make good on their guarantees (which eventuality is not anticipated), they will account for the expenditures in the same manner as they are now treating their contributions, that is, by charging such expenditures to operating expense Account 801.

Of course, if the petition is granted, the petitioners would have to show on their balance sheets, by notation or otherwise, the contingent liability which would be created by their undertaking to guarantee a portion of the notes to be issued by PRDC.

The record indicates that no attempt has been made to collect or segregate the costs representing the time and expenses of the officers and employees of the petitioners working on the PRDC project, attending meetings, etc. The amounts involved are probably not large but, as a matter of proper accounting, all expenditures incurred by the petitioners in connection with this project should be reported in a special sub-account of Account 801, and clearly set forth in their annual reports to this Commission.

[4601]

*Conclusions and Recommendation*

On the basis of the record in this proceeding, it is concluded that the execution of the guarantee agreement would constitute evidence of indebtedness within the meaning of Section 69 of the Public Service Law, and the petitioners properly brought this matter before the Commission for its approval.

These companies, and public utilities generally, have a responsibility to participate in research and developmental work aimed at the eventual commercial use of nuclear materials for the generation of electricity and the desire of the petitioners to take part in a program such as PRDC has undertaken is commendable and in the public interest.

It is therefore recommended that the joint petition of Central Hudson Gas & Electric Corporation, Long Island Lighting Company, and Rochester Gas and Electric Corporation for authority to execute a guarantee agreement in the form appended to the petition as Annex C thereto, be granted.

February 6, 1957

TJB:DH

APPROVED BY THE COMMISSION FEB 18 1957

[4731]

## Exhibit Acker 20

## SUMMARY OF MATERIAL ON ORDER

Acker  
Exh. #7

No.	Item	Proposal From	On Order By	Estimated Amount Without Contingencies (Acker Exh. #7)	Order Amount
B-2	Containment Vessel	Chicago Bridge & Iron Co. Dec. 24, 1956	PRDC	\$555,700	\$555,700
B-3	Hold-down Plate and Actuator	General Electric Co. Feb. 28, 1956	APDA	167,500	145,000
C-1	Primary Shield Tank	Chicago Bridge & Iron Co. Dec. 14, 1955	APDA	106,000	106,350
C-2	Reactor Vessel	Combustion Engineering Co. Oct. 17, 1955	APDA	915,800	915,800
C-3	Rotating Plug	Combustion Engineering Co. Oct. 17, 1955	APDA	346,350	346,350
	Index System & Drives	General Electric Co. Feb. 17, 1956	APDA	60,000	60,000
C-4	2 Control Rods	Allis-Chalmers Mfg. Co. Dec. 2, 1955	APDA	34,608	35,000
C-5	2 Control Rod Actuators	General Electric Co. Sept. 49, 1955	APDA	51,200	51,200
C-7	Overhead Crane	Whiting Corp. Dec. 19, 1956	PRDC	200,000	193,315
C-8	Offset Element Hand- ling Mechanism	General Electric Co. Aug. 25, 1955	APDA	190,500	190,500

(Con'd.)

[4732]

(Cont'd)  
SUMMARY OF MATERIAL ON ORDER

Acker  
Exh. #7

No.	Item	Proposal From	On Order By	Estimated Amount Without Contingencies (Acker Exh. #7)	Order Amount
D-1	1 Na Pump	Byron Jackson Oct. 7, 1955	APDA	3 Pumps for \$410,000	\$143,594
"	1 16" Check Valve	Edward Valves Co. Sept. 29, 1955	APDA	3 Valves for \$28,000	7,700 (Valve purchased and received)
D-5	1 Sodium Piping Loop	M. W. Kellogg Co. Oct. 28, 1955	APDA	3 Loops for \$165,000	59,628
D-6	6" Blanket Flow Valve	Copes-Vulcan Co. (Re-bid Jan. 3, 1957)	APDA	3 Valves for \$30,000	14,635

NOTE: In addition to the foregoing, construction work on reactor containment vessel foundations and external concrete work (Acker Exh. 7, Item B-1) has been contracted for and completed to the extent therein stated, and a portion of the steel plate shielding and structural steel listed in Item B-3 has been ordered from N. C. Mahon Co. and Ingals Iron Works Co., respectively.

Fill and muck removal and provisions for rip-rap materials (Items #1 and A-2) have been completed at a total cost to PRDC of \$152,580.87. Most of the yard lighting has also been completed (Item A-8) at a cost to PRDC of \$6,370.47.

[4751]

**Exhibit Acker 26****PLUTONIUM REVENUES BASED ON PLUTONIUM  
PRICE OF \$12.00 PER GRAM AFTER JUNE 30, 1963  
ON UNESCALATED AND ESCALATED BASES.**

<i>Year ended August 31</i>	<i>Plutonium Price \$12.00 per gram after June 30, 1963</i>	<i>Plutonium Price after June 30, 1963 \$12.00 per gram escalated at 4.2% pursuant to basis set forth in AEC Announce- ment dated May 31, 1957</i>
1962	\$ 622,000	\$ 787,000
1963	1,200,000	1,578,000
1964	849,000	1,155,000
1965	1,057,000	1,515,000
1966	1,776,000	2,654,000
1967	1,468,000	2,261,000
1968	1,385,000	2,248,000
1969	1,477,000	2,495,000
1970	1,879,000	3,275,000
1971	2,426,000	4,454,000
<b>Total:</b>	<b>\$14,139,000</b>	<b>\$22,422,000</b>
<b>Total Plutonium Revenue Based \$30 per gram Unescalated price after June 30, 1963 (Exhibit XLIV)</b>	<b>32,750,000</b>	<b>32,750,000</b>
<b>Difference:</b>	<b>\$18,611,000</b>	<b>\$10,328,000</b>



4752

[4752]

**Exhibit Acker 27****REVISED ESTIMATE OF WASTE DISPOSAL  
EQUIPMENT.**

(Exhibit Acker #7, Item I-5).

<i>Item</i>	<i>Estimate</i>
2 Hold-up basins (concentric construction) .....	\$ 80,000
6 Hold-up tanks .....	22,500
Piping .....	12,000
Waste Storage Building .....	16,000
Sypron Tank .....	15,000
Basin Liners (if required) .....	20,000
Bailing Equipment .....	5,000
<b>Total:</b> .....	<b>\$170,500</b>
Contingency allowance 15%: .....	25,575
<b>Total including contingencies:</b> .....	<b>\$196,075</b>

[4753]

**Exhibit Acker 28****ACTUAL AND ANTICIPATED EXPENDITURES BY  
PRDC AND APDA COMBINED APPLICABLE TO  
PRDC REACTOR PROJECT.**

A. *Estimated Plant Cost* \$31,675,000

(Per CAY estimate, new  
schedule, Exh. XLII, ex-  
cluding allowance for work-  
ing capital)

[ Estimate old schedule,  
Exh. XXVII, = \$31,225,000 ]

B. *Administrative and Overhead Expenses*

1. PRDC (Exh. XLIII, new schedule)	\$2,170,000	
[- Estimate, old schedule, Exh. XXVII = \$1,816,000]		
2. APDA Actual Expenses 1954-1956 (Exhibit Acker #4)	\$1,015,879	
3. APDA Budgeted Expenses allocable to PRDC (66-2/3% of total budgeted expenses of \$1,242,100, Exh. Acker #4)	\$ 828,067	\$ 4,013,946

C. *Engineering and Design Expenses in Addition to Those Included in CAI Cost Estimate*

1. APDA actual expenses 1954-1956 (18% of actual total "research and other test expenses" for 1954-56 of \$5,429,021, Exh. Acker #4)	\$ 977,224	
2. APDA budgeted expenses, 1957-58 (18% of 66-2/3% of \$6,514,687 budgeted "research and other test expenses" for 1957-58*, Exh. Acker #4)	\$ 781,762	\$ 1,758,986

\* None of 1959 "Research and other test Expenses" (Exh. Acker #4) is estimated to be allocable to additional engineering and design expenses. At least 66 2/3% of the item referred to is estimated to be allocable to PRDC work.

## [4754]

D. *Research and Development Expenses*

(Other than Engineering and Design)

- |  |             |              |
|--|-------------|--------------|
| 1. APDA predecessor companies, 1952-53 (Exh. Acker #4, "undistributed expenses")   | \$          | 619,932      |
| 2. APDA Actual Research Expenses, 1954-1956, of \$5,429,021 (Exh. Acker #4, "research and other test expenses"), less \$977,224 allocated to engineering and design expenses, item C. 1, above                               | \$4,451,797 |              |
| 3. APDA Budgeted Research Expenses 1957-59 allocable to PRDC (66-2/3% of total "research and other test expenses" for 1957-59 of \$8,939,327, less \$781,762 allocated to engineering and design expenses, item C. 1, above) | \$5,177,790 |              |
| 4. PRDC Research   | \$5,000,000 | \$15,249,519 |

E. *Non-Nuclear Component Test Expenses*

- |   |    |         |
|---|----|---------|
| 1. APDA Budgeted Expenses for Major Components Test Operations 1958-59 (Exh. Acker #4)                  | \$ | 724,573 |
| 2. APDA Budgeted Expenditures on test equipment and devices over and above items included in plant cost |    |         |

estimates (\$4,437,623 in Exh. Acker #4, less \$4,131,700 in Exh. Acker #6) .....	\$ 305,923	\$ 1,030,496
F. Allowance for Working Capital .....		\$ 1,175,000
Total .....		<u>\$54,902,947</u>

## [4755]

## Notes

The figures included in the foregoing are taken from Application Exhibit XLII and Exhibit Acker 4. In order to be conservative the plant costs and PRDC administration expenses have been based on the proposed new construction schedule.

APDA actual and anticipated expenses set out in Exhibit Acker 4 have been allocated as follows:

- (1) All of the actual APDA expenditures through the end of 1956 are allocated to the PRDC project.
- (2) All of the major component test expenses, actual and anticipated, and including both operations expenses and equipment and devices are allocated to the PRDC project.
- (3) Two-thirds (66-2/3%) of anticipated "research and other test expenses" and of anticipated "administrative expenses" are allocated to the PRDC project, the other one-third being assumed to be for advanced planning and general research. This is believed to be a conservatively low allocation. For convenience, the 66-2/3% has been applied equally to all three years; as a practical matter, however, a high-

er percentage of APDA work will be devoted to the PRDC project in the earlier portion of this period, and a smaller percentage in the later portion.

(4) Of the "research and other test expenses" set out in Exhibit Acker 4 and allocated to the PRDC project, 18% for the years 1954 through 1958 is estimated to be for engineering and design services by APDA. The remainder is estimated to be other research, development, and test expenses. Since most of the design work is expected to be completed before 1959, none of the anticipated APDA expenditures for that year has been allocated to engineering and design costs.

[4756]

(5) On the foregoing basis, APDA's budgeted expenditures for equipment and devices for the component test operation and for research, design and test work in 1957-1959 allocable to the PRDC reactor are in excess of \$10,000,000. In its own cost projections, however, PRDC has conservatively valued the equipment and services to be received from APDA in this period at \$7,000,000, of which \$3,000,000 has been allocated to equipment and devices incorporated in the reactor, and \$4,000,000 to services, including design, test operations and research. This is, of course, in addition to the cost of APDA research and design work done in previous years, none of which has been incorporated in the PRDC cash flow projections or cost estimates.

[4757]

**Exhibit Acker 29****PRDC COMMITMENTS AND EXPENDITURES ON RESEARCH**

ALREADY LISTED IN EXHIBIT ACKER NO. 11

	Commitment	Amount Expended as of May 31, 1957
1. <i>William McGuire and Gordon P. Fisher</i> Containment studies. Commitment has been increased from \$5,000 to \$10,000.....	\$10,000	\$ 6,239
2. <i>General Nuclear Engineering Corporation</i> Cask car design. Commitment has been in- creased from \$50,000 to \$60,000. ....	\$60,000	\$23,020
3. <i>Nuclear Metals, Inc.</i> Meltdown experiments .....	\$60,000	\$32,228
4. <i>The Regents of the University of Michigan</i> Meteorological evaluation. Commitment has been increased from \$27,000 to \$45,000 and includes cost of tower and instrumentation. ...	\$45,000	\$36,417

**ARRANGEMENTS POST-DATING EXHIBIT ACKER NO. 11**

	Estimated Cost	Amount Expended as of May 31, 1957
1. <i>Holley Carburetor Company</i> Control system simulator study .....	\$135,125	—
2. <i>Armour Research Foundation</i> Containment studies .....	\$ 10,000	—

[4758]

Amount  
Extended  
Estimated as of  
Cost May 31, 1957

3. <i>General Nuclear Engineering Corporation</i> General consulting services (Dr. Walter H. Zinn) .....	\$ 25,000	-
4. <i>University of Michigan</i> Site studies: meteorological diffusion (W. E. Hewson); off-site ground water (J. H. Zumberge); lake currents (J. Ayers) .....	\$ 50,000	-
5. Consultants (physics and site) .....	\$ 30,000	-
Totals: .....	\$425,125	\$975

Note: Above list excludes APDA-PRDC contract which involves payments by PRDC to APDA.

[4759]

# APDA COMMITMENTS AND EXPENDITURES (SINCE JANUARY 1, 1957) ON RESEARCH AND OTHER TEST WORK RELATED TO PRDC PROJECT

## 1. *Expenditures*

Of APDA research expenditures in the total amount of \$1,154,118 listed on Schedule C of Exhibit XXXVIII for the period January 1-June 30, 1957, there was related to the PRDC project approximately .....

\$1,011,000

## 2. *Commitments*

As of June 30, 1957 APDA had formal or informal commitments for research and



development work of approximately  
\$1,302,000, of which there is allocated to  
the PRDC project approximately 1,124,000

Total APDA expenditures and Com-  
mitments for Research, Tests, etc.,  
Related to PRDC project \$2,135,000

[4830]

**Intervenors' Exhibit 5**

**UNITED STATES ATOMIC ENERGY COMMISSION  
PLUTONIUM GUARANTEED FAIR PRICES**

U. S. FEDERAL REGISTER—JUNE 6, 1957

Volume 22 Page 3985

1. The prices contained in this schedule are "guaranteed fair prices" determined in accordance with the provisions of section 56 of the Atomic Energy Act of 1954 for plutonium lawfully produced under license from the Atomic Energy Commission, and delivered to the Commission at the designated receiving point within the time specified below.
2. Guaranteed fair prices previously established by the Commission for plutonium delivered to the Commission after January 31, 1957, are superseded by the prices established in this schedule.
3. It is emphasized that, while the Commission intends to extend the guarantee period for plutonium prices each year for one additional year, the prices which will be established for subsequent years may be different from those

previously in effect. In particular, it is the expectation of the Commission that the prices for plutonium will be reduced, as dictated by consideration of the value of the material for its intended use by the United States and giving such weight to the actual cost of producing the material as the Commission finds to be equitable, to a level based upon the fuel value of plutonium in commercial power reactor facilities.

4. Chemical specification: Total plutonium content to be not less than 99.5% by weight.

5. Physical specification: The content of beta and gamma emitting isotopes other than plutonium will be measured indirectly in terms of the radiation level. The average radiation level of a shipment of buttons shall not exceed  $\frac{1}{3}$  mr/hr/gram. The radiation level of any one button, enclosed within a plastic envelope shall not exceed  $\frac{1}{2}$  mr/hr/gram. These measurements are to be made with an air ionization type gamma survey meter with window closed, at a distance of two inches from the button "top."

6. Form: Solid metal buttons, free of slag, reductant, and mold fragments. Buttons to weigh not less than 200 grams each nor more than 2.0 grams each.

7. Packaging: The plutonium metal is to be packaged in suitable containers and shipped in accordance with Government regulations.

AEC will either return reusable containers to common carrier at the designated receiving point or will make proper adjustment for the value of the containers.

8. Prices paid will be as follows:

(a) For plutonium delivered to U. S. Atomic Energy Commission at designated receiving point during the period beginning February 1, 1957 and

[4831]

ending midnight June 30, 1962:

<i>% Pu-240:</i>	<i>Price \$/gr of Plutonium</i>
0.0 .....	45.00
2.0 .....	41.50
4.0 .....	38.00
6.0 .....	34.50
8.0 .....	31.00
8.6 and over .....	30.00

(b) For plutonium delivered to U. S. Atomic Energy Commission, at the designated receiving point during the period beginning July 1, 1962 and ending midnight June 30, 1963: \$30 per gram of plutonium.

9. The designated receiving point is U. S. Atomic Energy Commission, Rocky Flats Plant, Rocky Flats, Colorado (a suburb of Denver, Colorado).

10. Fair prices paid by AEC for special nuclear materials which meet the specifications set forth above and are delivered to designated receiving points prior to midnight June 30, 1963, may not be reduced by the Commission except as provided in this paragraph. The prices are, however, subject to upward or downward adjustment semiannually when substantial changes have occurred in the "Wholesale Price Index, excluding Farm Products and Processed Foods," published by the Bureau of Labor

Statistics. The July 1955 index of 116.5 (1947-1949 = 100) is used as the initial base. If the October index of any year is greater or less than the base index by five percent or more, the prices may be adjusted the following January 1. Similarly, if the April index of any year is greater or less than the base index by five percent or more, the prices may be adjusted the following July 1. Prices may be adjusted by the percentage change which has occurred in the index, the adjusted prices being computed to the nearest cent. Following such an adjustment, the index used in computing the adjustment will become the new base.

11. Interested persons may contact:

U. S. Atomic Energy Commission  
Division of Civilian Application  
1901 Constitution Avenue  
Washington 25, D. C.

Dated at Washington D. C., this 31st day of May, 1957.

FOR THE ATOMIC ENERGY COMMISSION

R. W. COOK

*Deputy General Manager.*